VOLUME 31 NUMBER 7 JULY, 1948

AMERICAN JOURNAL OF OPHTHALMOLOGY

THIRD SERIES FOUNDED BY EDWARD JACKSON

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Subscription price in United States ten dollars yearly. In Canada and foreign countries twelve dollars. Published monthly by the Ophthalmic Publishing Company. Subscription and Advertising Office: 664 North Michigan Avenue, Chicago 11, Illinois. Entered as second class matter at the post office at Menasha, Wisconsin.

AMERICAN JOURNAL OF OPHTHALMOLOGY

VOLUME 31 JULY, 1948 NUMBER 7

DACRYOCYSTITIS OF INFANCY*

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The treatment of dacryocystitis of infancy is still a controversial subject. The majority of the literature on this subject advocates conservative treatment and is opposed to early probing of the nasolacrimal duct. The tear-sac infection in infants is due to an imperforate lumen of the lacrimal duct with a retention of infected tears in the sac. Many ophthalmologists believe that a long period of irrigation with massage of the sac should be employed because of some bad effects that might ensue from early probing of the duct. One hundred cases that I treated by early probing of the duct cleared up promptly without incident or bad effects from such management.

REVIEW OF THE LITERATURE

In a recent review of the literature I found 15 papers recommending early probing of the duct to clear up the dacryocystitis of infancy and 18 that decried manipulation of the duct, the latter favoring conservative management with local antiseptics and sac massage for a period varying from 2 to 24 months. Among those favoring early probing were Weeks, Zentmayer, Ollendorf, Green, Nagel, Meller, Ferrer, Pesne, Berens, Sanford Gifford, Becker, Wiener and Alvis, Walker, and Judge. Those opposed to probing and advocating a prolonged period of conservative treatment were Posey, Klinedinst, Edward Jackson, Roy, Curdy, McMurray, Crigler, Rollet, Campbell, Botteri, Busacca, Meek, Hardesty, Moret, Arruga, Harold Gifford, and Guerry.

Several members of the Chicago Ophthalmological Society have contributed to the literature on this subject. The two papers that I wish to review are those of H. W. Woodruff and of Roy Riser. Dr. Woodruff, in 1931, pointed out that the majority of these infants come to the ophthalmologists at about six months of age. Some only require sac irrigation, while others need to have their nasolacrimal ducts probed. In some instances, he found it necessary to pass a second probe into the nose rubbing the two instruments together to break through the mucosa and establish a lumen from the duct into the nose.

Riser, in 1935, reported 44 instances of dacryocystitis of infancy, most of which were seen at about six months of age. Conservative treatment for 2½ months resulted in subsidence of the symptoms in 21 cases. Only 50 percent, however, were relieved by conservative treatment. Nine cases were probed and their symptoms subsided promptly.

EMBRYOLOGY AND DEVELOPMENTAL ANATOMY

To understand the pathogenesis of dacryocystitis of infancy better, the works of J. Parsons Schaeffer and of M. Schwartz of Tubingen should be considered. These two authors have made such valuable contributions to the embryology and developmental

* Read before the Chicago Ophthalmological Society, October 6, 1947. The author gratefully acknowledges the assistance given by the staff of the South Bend Medical Foundation, Inc., in the preparation of the embryology and the illustrations.

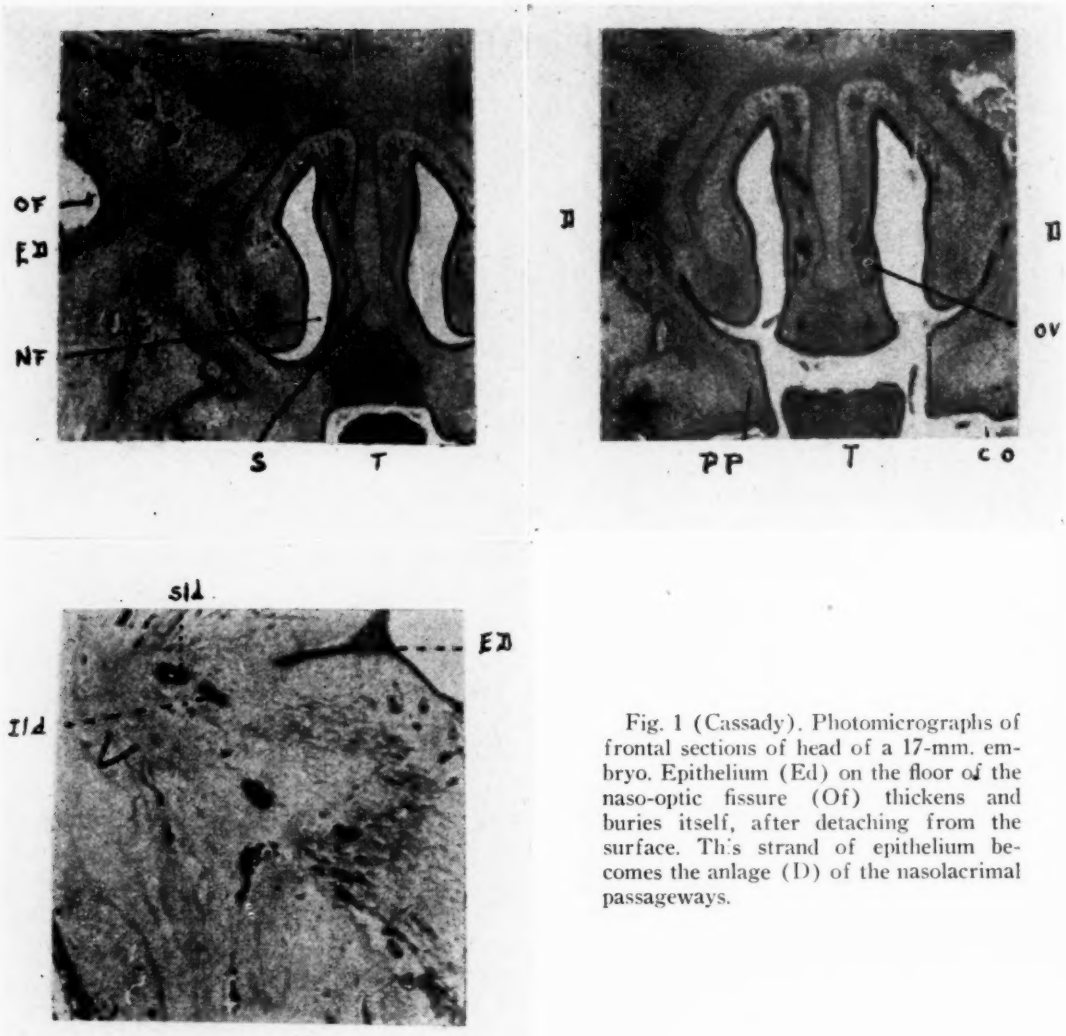

Fig. 1 (Cassady). Photomicrographs of frontal sections of head of a 17-mm. embryo. Epithelium (Ed) on the floor of the naso-optic fissure (Of) thickens and buries itself, after detaching from the surface. This strand of epithelium becomes the anlage (D) of the nasolacrimal passageways.

KEY TO ABBREVIATIONS IN FIGURES

Co—Cavum oris
D—Anlage of nasolacrimal passageways
Ed—Thickened surface ectoderm
If—Inferior turbinate
Ild—Inferior canaliculus anlage
Inm—Inferior meatus
Lm—Nasolacrimal membrane
Mm—Middle meatus
Nf—Nasal fossae
Nld—Nasolacrimal duct
Of—Naso-optic fissure
Ov—Organon vomeronasale
Pp—Processus Palatinus
S—Septum nasi
Sld—Superior canaliculus anlage
T—Tongue
Y—Detritus in lumen of unruptured duct

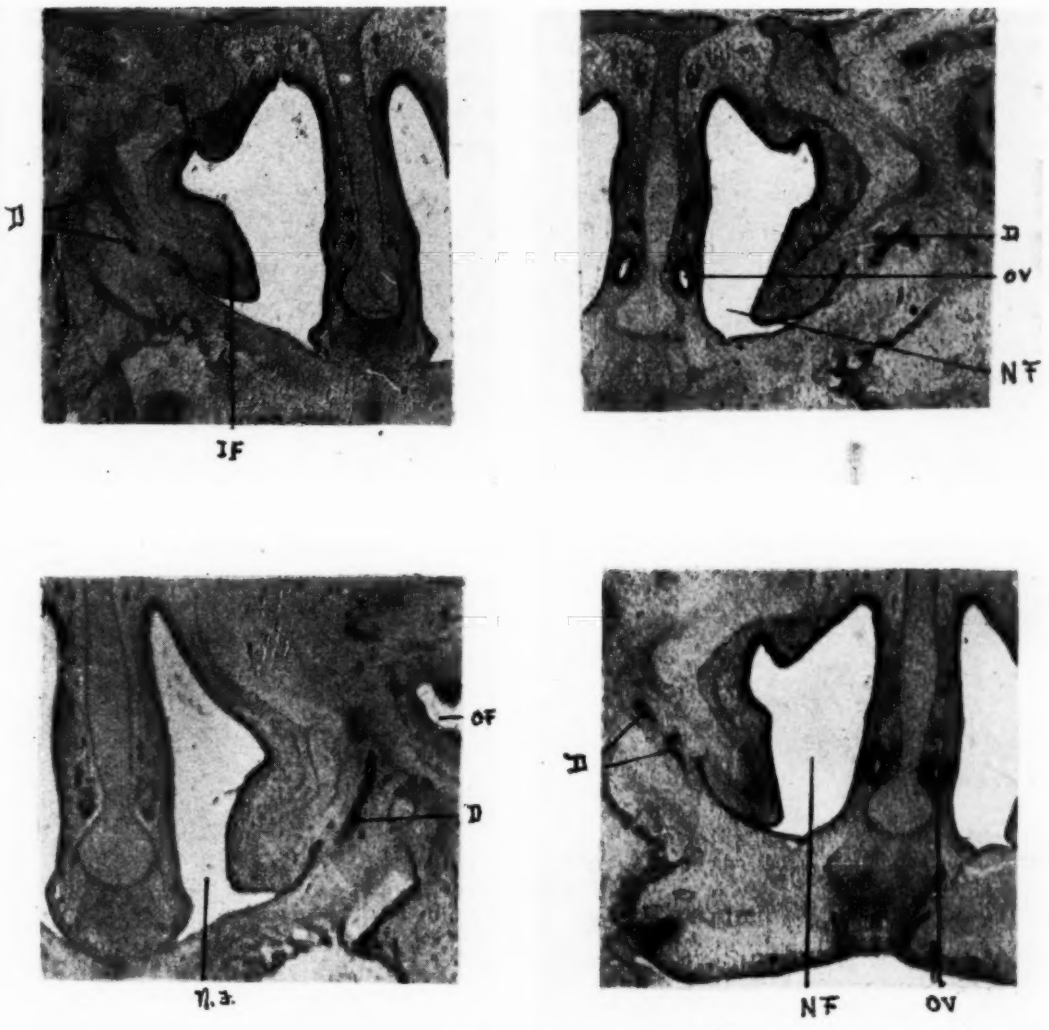

Fig. 2 (Cassady). Photomicrographs of frontal sections of 25-mm. human embryo. Solid epithelial rests (D) buried in the mesenchyme are formed between the nasal fossae (Nf) and the naso-optic fissure (Of).

anatomy of the nasolacrimal duct that, in spite of your familiarity with their work, I would like to review it.

"The nasolacrimal duct starts in the 12-mm. embryo from a thickening of epidermal cells which grows down into the mesenchymal tissue and detaches itself from the surface ectoderm. This epithelial cord begins to develop a lumen by the third month: sections through 100-day embryos show that the superior and inferior canalicular cords have extended to the free margin of the eyelids and that the nasal end of the mother cord of cells has reached the nasal mucous membrane. The ocular end establishes a lumen long before the nasal end and the latter is delayed approximately until birth or a little later. The last portion to become patent is the site of coalescence between the nasal sprout of the mother cord and the nasal mucous membrane. The position of the ostium, whether

at the highest point of the inferior meatus or at some lower site on the lateral nasal wall, and the shape of the ostium, whether large, wide open, or more or less guarded by folds of mucosa, depend upon the point

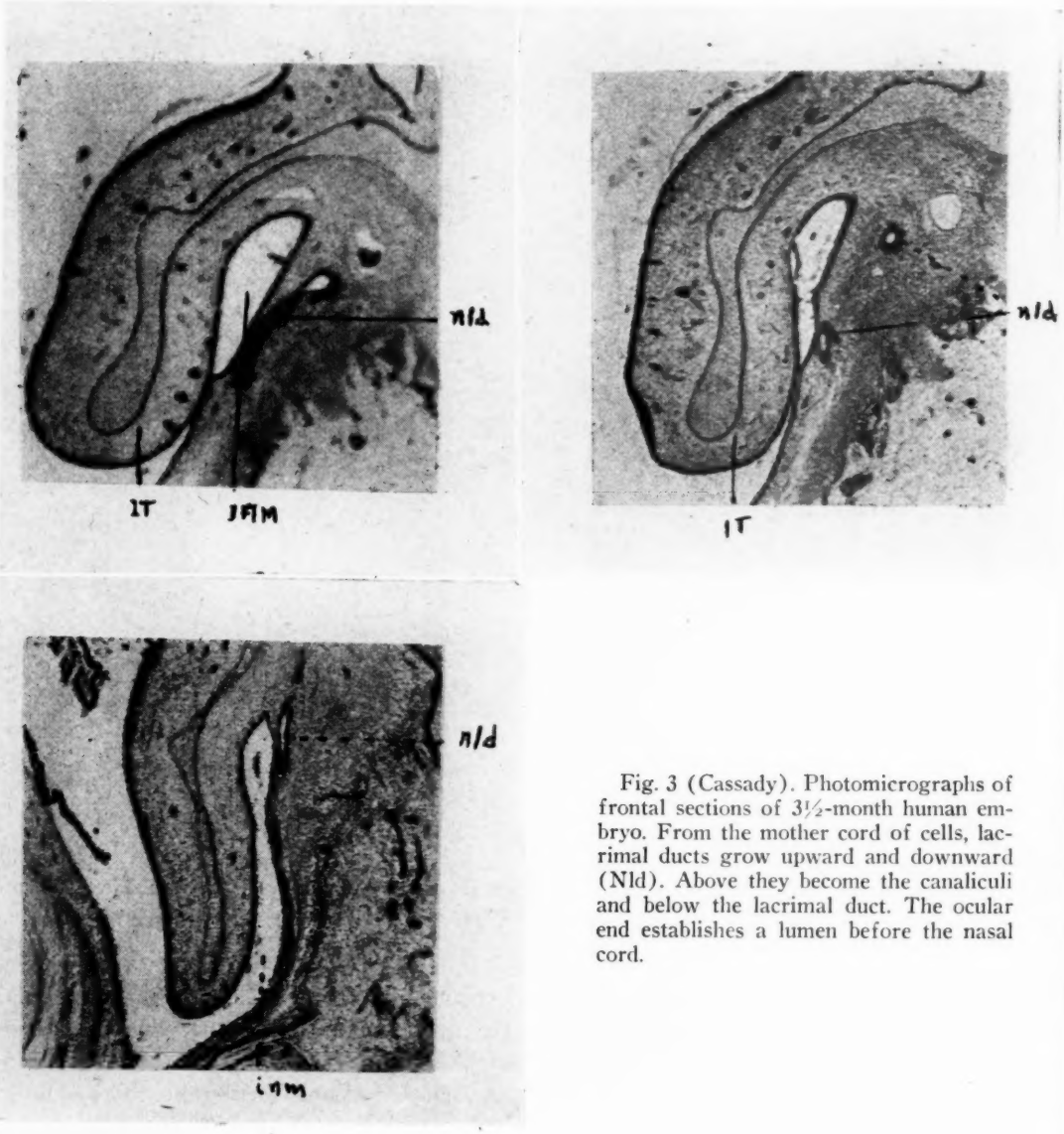

Fig. 3 (Cassady). Photomicrographs of frontal sections of 3½-month human embryo. From the mother cord of cells, lacrimal ducts grow upward and downward (Nld). Above they become the canaliculi and below the lacrimal duct. The ocular end establishes a lumen before the nasal cord.

and extent of coalescence between the nasal end of the mother cord and the nasal mucosa." This description is that of J. Parsons Schaeffer. He further goes on to say, "The nasal ostium of the duct may (1) fail of canalization, and its membrane remain in-

tact, (2) be of microscopic size and inadequate for normal function, (3) be buried in mucosa of the lateral wall of the inferior meatus and guarded by a valvelike fold of mucous membrane, (4) be wide open and adequate." (See Figures 1, 2, 3, 4, 5, 6, and 7.)

Schwartz, in 1935, after examining 207 nasolacrimal ducts in fetuses in the 8th, 9th, and 10th fetal months, found 35 percent had atresia or an imperforate lumen of the nasal

ostium. Some of these were associated with a terminal cyst or bulla and were ruptured by the trauma incident to delivery. The closed lumen was present in the stillborn in about the same proportion as in the older fetuses.

brane separating its lumen from the nasal cavity, indicate that passing a probe through into the nose should be the preferred method of treatment.

Prolonged conservative treatment, with

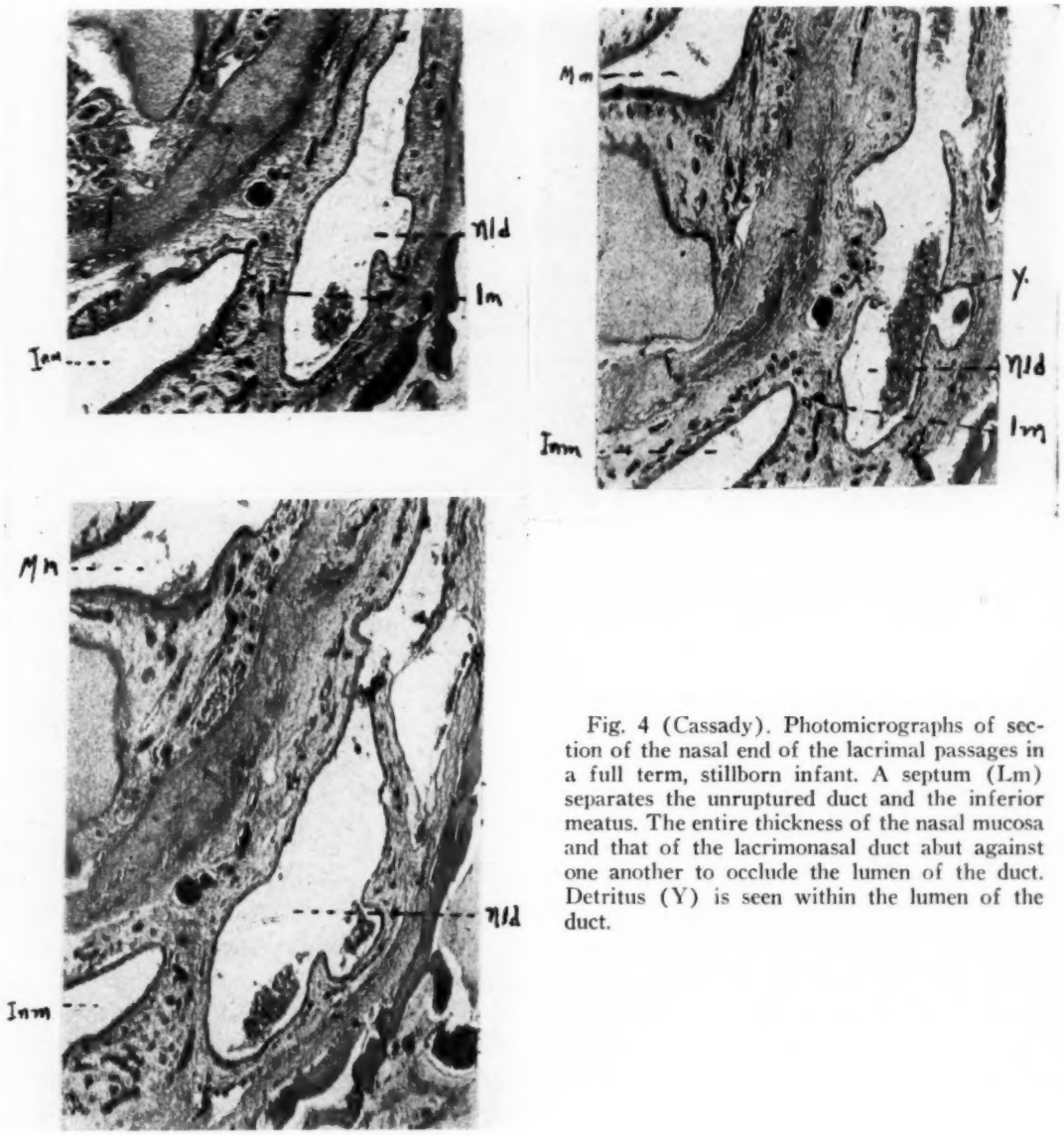

Fig. 4 (Cassady). Photomicrographs of section of the nasal end of the lacrimal passages in a full term, stillborn infant. A septum (Lm) separates the unruptured duct and the inferior meatus. The entire thickness of the nasal mucosa and that of the lacrimonasal duct abut against one another to occlude the lumen of the duct. Detritus (Y) is seen within the lumen of the duct.

The delayed development of the nasal ostium of the nasolacrimal duct, its failure to open at or near birth, the high incident of atresia of the duct, yet its practically complete lumen except for the imperforate membrane separating its lumen from the nasal cavity, indicate that passing a probe through into the nose should be the preferred method of treatment.

Prolonged conservative treatment, with its resultant sac distention, trauma, and infection of the passage, is likely to result in permanent distention and loss of elasticity, as well as endangering the eye from a purulent dacryocystitis. Several instances of loss

of an eye from dacryocystitis in infancy are reported in the literature (Granstrom, 1938).

"Atresia in the newborn is due to an unruptured lacrimal nasal membrane and in these surgical intervention may be necessary (Schaeffer)." Schaeffer, in a personal communication, is of the opinion that Schwartz's figure of 35 percent imperforate nasolacrimal ducts at birth is a conservative one.

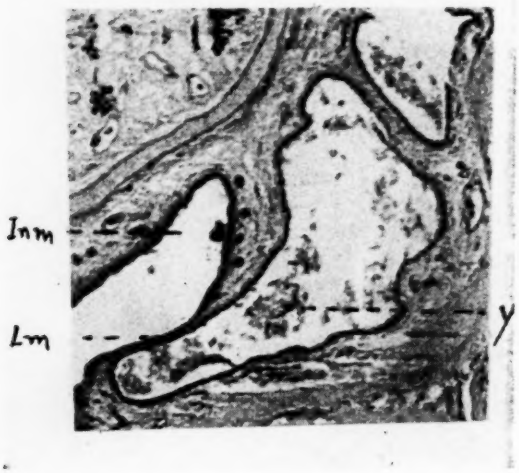

Fig. 5 (Cassady). Photomicrographs of section of the lower end of the nasolacrimal duct of a stillborn infant. The nasolacrimal membrane (Lm) separating the lower end of the duct from the inferior meatus (Inm) is very thin, but unruptured. Detritus (Y) is in the dilated lumen of the duct.

Incidence of dacryocystitis

A large percentage of nasolacrimal membranes are not ruptured at birth. The incidence of dacryocystitis of infancy has been reported as 1.75 percent in some 1,500 infants. In a local series of 279 infants, dacryocystitis occurred in 14 instances or 5 percent. This latter figure probably is higher than usual because special inquiry was made by pediatricians and careful examination for dacryocystitis was done in each of the 279 infants.

The reason why infection of the nasolacrimal sac is not seen more often is probably due to the fact that, although a patent lumen may not exist at birth, tears do not form at once and the need for patency of the duct does not occur until later. There are no definite figures in the literature as to just how early tears occur in infants. In an investigation of this subject in newborns and infants by our local pediatricians, the same 279 infants were investigated by asking their parents to note when they first cried tears. The time at which tears appeared varied from 1 to 12 weeks. The average time at which tears first appeared was at 3⅓ weeks.

Although the lacrimal passages may not be patent at or near birth, it is probable that they become patent within the first week or two after birth, before tears start. If dacryocystitis develops, it may resolve spontaneously as soon as the patency of the duct is established. This may occur without probing the duct if prolonged conservative treatment and watchful waiting are employed. If, however, the duct is not patent by 2 or 2½ months, or when these patients appear in the ophthalmologist's office for advice, it is unlikely that the membrane will rupture spontaneously.

Method of treatment

In 100 cases of dacryocystitis in infancy that I have seen and treated, so-called radical treatment was used; the duct was probed open at once without a trial period of conservative treatment. In almost all of these cases, an attempt to wash the sac with a lacrimal syringe showed the duct impatent and the solution would not go through into the nose. Only after the nasal duct was probed and its patency established would the solution go through. In other words, there is a membrane separating the nasal from the lacrimal duct mucosa. This obstructs the lower end of the nasolacrimal duct and its rupture is essential to establish free passage through the duct. As long as obstruction or an imperforate lumen exists into the nose, dacryocystitis persists. Local treat-

ment of the dacryocystitis with antiseptics or antibiotics may clear up the infection in the sac, but the sac will not remain clear and function properly until the lumen is open into the nose. Treatment which does not establish a lumen is too conservative and results in prolonged sac distention with more trouble than from radical treatment.

In my cases, the dacryocystitis subsided promptly with 1 or 2 treatments and in three fourths of the instances subsided within a few days to a week after probing. In other words, although there was a dacryocystitis of 2½ to 3 months' duration before probing was done, one office treatment was all that was necessary to cure the disease.

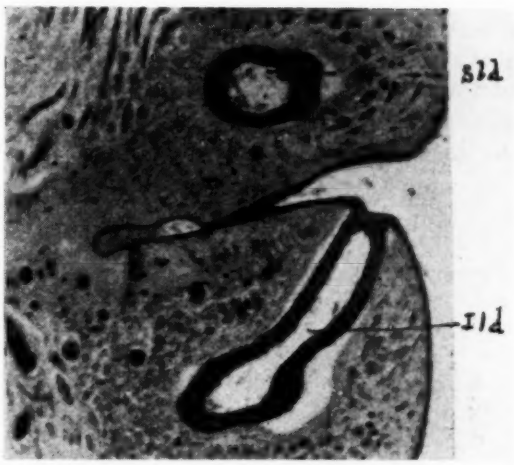

Fig. 7 (Cassady). Photomicrograph of section showing the upper and lower canaliculi, the lower at its vertical portion, the upper at its horizontal portion with patent lumen.

Technique of probing

Topical local anesthesia was used along with restraint of the child. The child was tightly swathed with the arms extended at the sides. The shoulders and head were held by the nurse. Pontocaine or butyn conjunctival instillations were used, and the duct was probed. The operator sat at the head of the table looking down toward the lower canaliculus, the illumination behind him directed at the punctum.

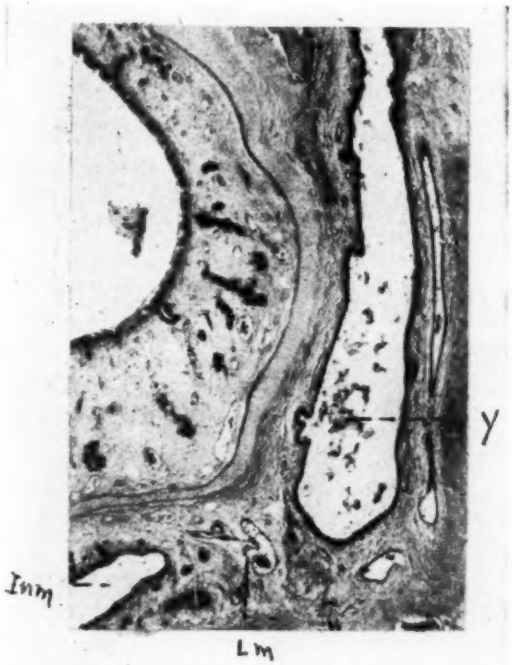

Fig. 6 (Cassady). Photomicrograph of section of the nasal end of a nasolacrimal duct in a stillborn full term infant. Although serial sections were used to find a thin lacrimal nasal membrane (Lm), no thinner could be found.

A conical punctum dilator was used to allow the introduction of a 23-gauge, 1-inch lacrimal cannula attached to a 2-cc. syringe containing normal saline. As soon as the cannula entered it, the sac was irrigated. As the cannula struck the osseous wall, it was turned from the horizontal to the vertical position where it passed easily down through the duct. Resistance of the membrane at its lower end is felt just before the cannula enters the nasal cavity. Perforation of this membrane is assured when the saline solution is injected and the infant swallows solution as it runs back into its throat.

The cannula attached to the syringe is used instead of a Bowman probe to simplify the procedure so that the irrigation and the probing can be accomplished with one probing of the duct.

A solution of penicillin, 2,500 units per cc., is prescribed as instillation drops for use at home for a few days after the office

treatment. If pus is still present in the sac at the next visit, the probing and irrigation are repeated. It is then possible to determine with the cannula whether or not the duct is patent. If it is plugged, the solution cannot be irrigated through into the nose until the canal is again probed.

Results

If carefully done, there is no danger from this type of treatment. In 100 cases, only one instance of a false passage occurred. This ballooned the tissue outside the lumen of the duct with saline. In this instance, the probe was withdrawn, reintroduced into the upper puctum and canaliculus, and the patency of the duct was established without untoward effect. The subcutaneous edema promptly disappeared, and the dacryocystitis had entirely cleared up within a week. The best security against creating a false passage is adequate immobilization of the child and careful, gentle handling of the cannula.

The average length of treatment using this method was between 10 days and 2 weeks. Some sac infections which had persisted for several months did not clear up with a single probing. The sac was distended and stretched with an infected mucosa for such a period of time that it had lost its elasticity and recuperative ability. When probing is delayed until the infant is six months of age, the ducts may not, in fact very often do not, clear up with one probing. If the duct is probed at the first visit to the eye physician, usually by 2 or 3 months of age, the infection clears up quite promptly and there are no untoward persisting symptoms.

Conclusions

A review of the developmental anatomy of the nasolacrimal duct shows that frequently the lumen of the duct is not patent at birth. About one third of newborn infants have a membrane over the lower end of the duct separating it from the nasal cavity. This is a common developmental defect which may or may not rupture before the passages are needed for tears. Tears first appear on an average at about 3½ weeks of age. The lumen is usually established by rupture of this membrane before tears start but if it is not, the sac distends, becomes infected, and dacryocystitis of infancy occurs. The incidence of this disease varies from 1.75 to 5 percent. Sometimes it will resolve spontaneously if the membrane ruptures but, in most instances, probing the duct is necessary to rupture the membrane mechanically.

The majority of articles in both the ophthalmic and pediatric literature advocate a long period of conservative treatment of dacryocystitis of infancy. The writers warn against early probing of the duct as being dangerous and radical and an unjustified method of treatment. In my own series of cases and also in those cases, reported in the literature, which did not respond to prolonged conservative management, the dacryocystitis subsided as soon as the duct was opened. (See Figures 4, 5, and 6.)

Summary

1. Tears start to form and appear at about 3½ weeks of age.

2. The incidence of dacryocystitis in infancy is somewhere between 1.75 and 5 percent.

3. Prompt subsidence of dacryocystitis can be obtained as soon as the lumen of the duct is adequately patent.

4. Early probing of the duct produces no untoward injury providing it is carefully and gently done.

5. Early probing of the nasolacrimal duct in infants is the method of choice for prompt subsidence of symptoms.

527 Sherland Building (9).

ANATOMIC FACTORS IN THE ETIOLOGY OF HETEROTROPIA*

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The present status of our knowledge of the etiology of heterotropia leaves much to be desired. There are almost as many classifications of heterotropia as there are ophthalmologists to enumerate them. One finds much overlapping in the various existing classifications and often there is frank disagreement. It has been said that when there are many treatments for any disease, their very multiplicity is excellent evidence that no single treatment is satisfactory; just so the many existing classifications of heterotropia make them all suspect to a certain degree. It is the purpose of this paper to present a rearrangement of the usual classification of the types of heterotropia based upon factual evidence and to suggest an outline of treatment based upon this classification.

CLASSIFICATION OF TYPES OF HETEROTROPIA

Most classifications have at least three main categories: (1) anatomic, (2) innervational, and (3) paretic. Under *anatomic,* there are listed such things as "muscles too large or too small," "unusual attachments of muscles," and, rarely, "complete absence of a muscle."

In the *innervational* group are lumped all heterotropias which seem to be on a basis of refractive error, all of those with an anomaly of either convergence or divergence, those with "a weak fusion faculty," those without obvious cause, and all cases wherein fusion is impossible by virtue of some organic obstacle such as cataract, retinal detachment, hole in the macula, unilateral optic atrophy, congenital amblyopia, and so forth.

The *paretic* group contains those patients with heterotropia due either to trauma or noxae or those with congenital paresis.

The conscientious ophthalmologist must sooner or later become dissatisfied with such a classification because he will encounter some cases that are "neither fish nor fowl." A closer study of these particular cases makes one suspect that many of them may be partly innervational, partly paretic, and partly something else. While all writers faithfully include the *anatomic* category, few cases are ever actually reported as belonging to this group and the average clinician seldom even considers it in making a diagnosis. The few cases which have appeared in the literature as belonging in this group were rarely if ever diagnosed before the patient was on the operating table and the diagnosis was often a subject of some consternation to the surgeon.

Chavasse[1] made an admirable attempt to explain the heterotropia associated with accommodative effort or the lack of it, yet one often sees patients that will not fit into his classification. Chavasse was, of course, fully aware of these misfits and said of them that they were patients in whom ". . . there is a lag in the development of the reflex which settles the rival claims of accommodation and convergence." What he neglected to say was that the foregoing comment might be made about almost any patient with heterotropia and can neither be proved nor disproved.

Having made these prefatory remarks, a statement can be made that will undoubtedly be considered rash. *Ninety percent of all cases of heterotropia appearing in the first six years of life have some underlying ana-*

* From the Department of Ophthalmology, Washington University School of Medicine, and the Oscar Johnson Institute. This study was done under a contract with the Office of Naval Research as Project N6onr-202, Task Order I. Read before the American College of Surgeons, Section on Ophthalmology, September 9, 1947, New York, New York.

tomic cause for the deviation. Is this heresy? It will seem so to many. A consideration of the evidence is in order.

Anatomic factors

The anatomic factors playing an important role in the etiology of heterotropia are three in number: (1) Abnormal check ligaments, (2) abnormal muscle slips, and (3) abnormal insertions. They will be considered in that order.

The check ligaments

The check ligaments of the oculorotary muscles are familiar, at least by name, to every student of ophthalmology. They are one of the subdivisions of the fascia of Tenon and arise from the sheath of each of the oculorotary muscles. They are faithfully mentioned in all texts on anatomy and carefully depicted, with those of the medial and lateral rectus usually being chosen for the illustration. The picture—always diagrammatic—suggests that each oculorotary muscle has a check ligament and this ligament is shown arising perpendicular to the muscle from its sheath and running a course parallel to the line of pull of the muscle. The check ligaments, however, are not as simple as the usual description implies, nor may they be dismissed with no more than a mere mention if one is truly interested in the etiology of heterotropia and of heterophoria.

These ligaments arise from the muscle sheaths and are inserted, for the most part, into the orbital wall—really into the periorbita. Parts of the check ligaments on the medical and lateral rectus are inserted into the medial and lateral palpebral ligaments and into the medial and lateral conjunctival fornices respectively. The ligament of the medial rectus is also inserted into the lacrimal caruncle. Whitnall[2] wrote that ". . . these expansions of the sheaths draw the fornices of the conjunctiva backwards, exactly as muscle fibers adjacent to joint capsules draw the slack of synovial membranes out of the way in extension, but a more important function is that by their fixation to the orbital walls they anchor the whole fascial apparatus of the globe in position."

Appropriately named *check* ligaments, their primary function is quite obviously one of preventing or checking excessive excursions of the globe which would be produced by the oculorotary muscle from whose sheath the ligaments in question arose. For example, the check ligaments of the medial rectus prevent excessive adduction of the globe, while those of the lateral rectus prevent excessive abduction. This fact is as obvious as it is well known.

What is not so well known is the fact that the check ligaments may serve to check movement *in two directions.* Not only may they serve to prevent any excessive rotation which might be produced by the muscle from whose sheath they arise, but they may also prevent effective relaxation of that same muscle when its antagonist is contracting if they are abnormally developed. A muscle that is constantly prevented from attaining full relaxation when its antagonist contracts becomes at first a tonically contracted muscle and later a moderately fibrotic one with a consequent loss in elasticity—a tremendously important fact in patients with heterotropia.

One need not necessarily go to the dissecting room to study the check ligaments. The ophthalmic surgeon in the course of an operation for heterotropia is presented with an unexcelled opportunity to study these ligaments if he cares to do so. And he has the advantage over the cadaver anatomist in that he is working with fresh, living, normally colored tissues.

The medial rectus is probably attacked by the surgeon more frequently than any of the other oculorotary muscles and its check ligaments offer more variation than those of any other muscle. They cannot be adequately and properly inspected and studied until the insertion of the medial rectus has been severed from the globe.

The medial rectus always has one check ligament running in the horizontal plane of the globe and this is the one so carefully depicted in all textbooks. It arises from the sheath just as does the dorsal fin of a fish at a point between 6 and 8 mm. posterior to the insertion of the muscle itself into the sclera. Even in the nonheterotropic patient

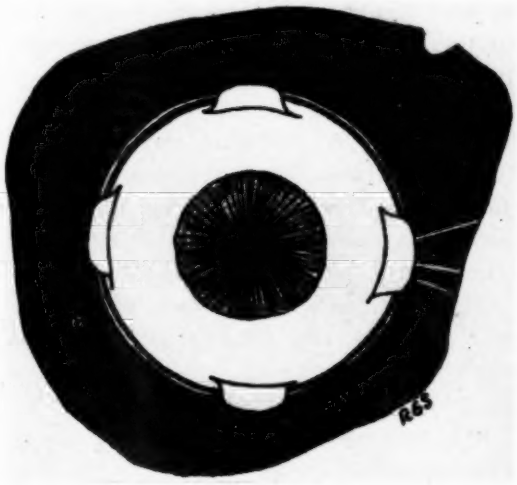

Fig. 1 (Scobee). Schematic diagram of the right eye viewed from the front showing the normal check ligaments on the medial rectus muscle. The intermuscular membrane is also shown as a thin white line running between all of the rectus muscles.

it is moderately thick and can be nicely visualized when put on a stretch by pulling the severed end of the medial rectus forward and toward the center of the cornea. Occasionally two very thin additional check ligaments are found in the normal person, one above and one below the main horizontal one. All three ligaments are shown in Figure 1.

In the patient with esotropia, several variations from the normal may be found, either separately or in combination. There may be any or all of the following: (1) Extra and thickened check ligaments, (2) fused check ligaments, and (3) posterior check ligaments.

(1) *Extra and thickened check ligaments.* A frequent finding is that of additional,

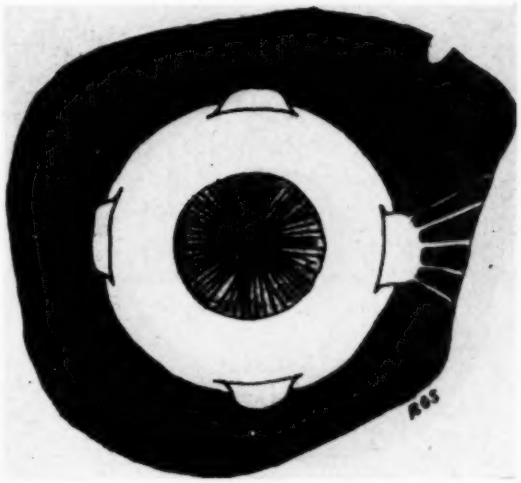

Fig. 2 (Scobee). Schematic diagram of the right eye showing extra and thickened check ligaments which are abnormal. The intermuscular membrane is not shown.

thickened check ligaments. The normal main horizontal ligament is present and quite obviously thickened and somewhat contracted. Extra check ligaments arise from a line paralleling the origin of the main ligament and either just above or just below it, as shown in Figure 2. They lie in planes which are oblique to the horizontal, in such a way that when put on a stretch they seem to fan out like the pages of a book from its binding when the covers of the book are purposely held wide open.

(2) *Fused check ligaments.* If the esotropia has been present from birth, it is not at all unusual to find that the 3 or 5 ligaments shown in Figure 2 are apparently fused together into a thick solid mass running from the muscle sheath to the orbital wall as in Figure 3. Such a mass is a dense ligamentous anchor which not only prevents excessive adduction by the medial rectus but it also prevents a normal excursion of the globe in abduction as well. Patients with esotropia and the fused type of check ligaments on the medial rectus will show:

(a) Definite although perhaps slight limitation of abduction of that eye in preoperative examinations.

(b) An absence of divergence of the

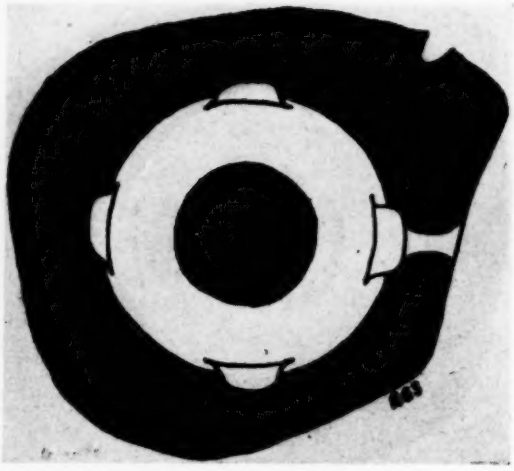

Fig. 3 (Scobee). Schematic diagram of the right eye showing a fused type of check ligament. It is quite thick and seems to be the product of fusion of several smaller ligaments. The intermuscular membrane is not shown.

eyes under general anesthesia, the esotropia either remaining constant in degree or decreasing only slightly.

(c) If, under general anesthesia, a muscle hook is placed in the lateral conjunctival fornix and depressed, this attempt to abduct the eye forcibly will result in a definite feeling of resistance to the abduction, and if abduction is forced by this method, the globe can easily be seen to retract.

(3) *Posterior check ligaments.* A final variation from the normal in the check ligaments of the medial rectus muscle in the esotropic patient is what could probably best be called a posterior check ligament. The normal check ligament arises from the muscle sheath just posterior to the level of the equator of the globe and when the ligaments are divided this far back, the external surface of the medial rectus is normally freed. A posterior check ligament, however, arises from the muscle sheath far back in the orbit and runs just as far anteriorly, inserting into the medial orbital wall along its entire course as shown in Figure 4. In order to section such a posterior ligament, one must often invade the orbit for a distance of perhaps 5 mm. past the level of the posterior pole of the eyeball. Until such posterior check ligaments are cut, the medial rectus will not stretch freely nor retract properly and the globe will not abduct as freely as it normally should.

Three variations from the normal check ligaments on the medial rectus muscle in patients with esotropia have been described:

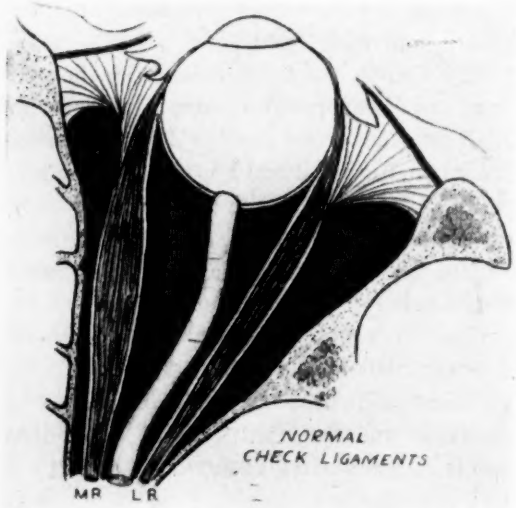

Fig. 4a (Scobee). Schematic diagram of the check ligaments of the horizontal muscles of the right eye as viewed from above.

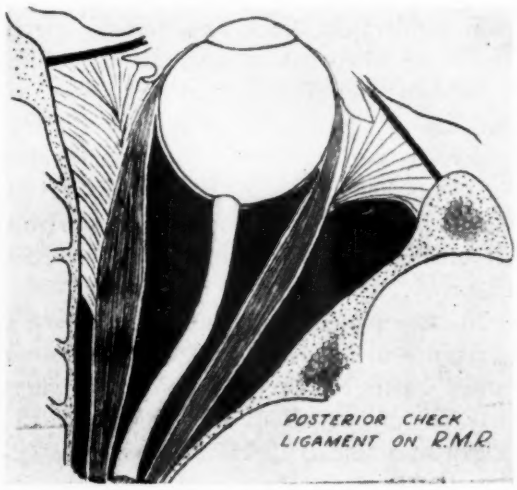

Fig. 4b (Scobee). The same as Figure 4a except that a posterior check ligament is present on the right medial rectus, and this is a definite anatomic anomaly.

(1) Extra and thickened check ligaments, (2) fused check ligaments, and (3) posterior check ligaments. The existence of any one or of all three together will prevent proper abduction of the globe with a muscle hook under general anesthesia, and may cause retraction of the eyeball if abduction is forced. The conscientious surgeon can, therefore, predict an abnormal check ligament or some other anatomic abnormality before he ever makes any incision at all.

free and unattached to retract indefinitely back into the orbit. On the contrary, the cut tendon retracts only from 3 to 5 mm. or even less because the capsule of Tenon which envelops the muscle is attached to the sclera at about the same distance from the cornea as the tendon insertion, and its connection with the muscle is sufficiently firm and intimate to serve as a secondary attachment for the muscle."

This structure running between the rec-

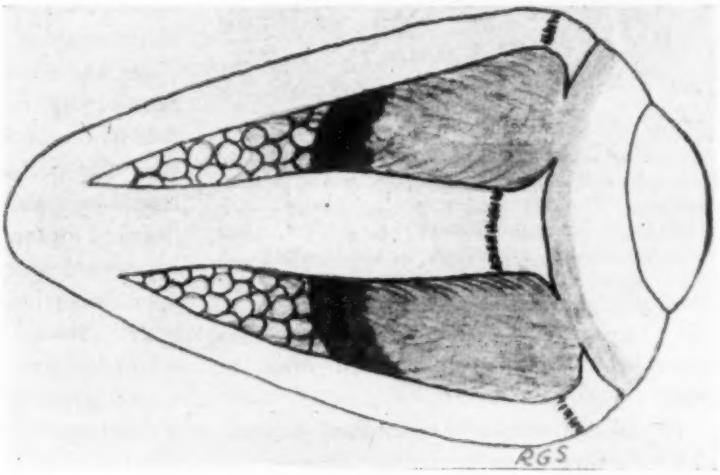

Fig. 5 (Scobee). View of the left eye from the medial surface to show the intermuscular membrane. The superior, medial, and inferior rectus are shown; running between them is the intermuscular membrane which is fairly dense anteriorly and thins perceptibly as it is traced posteriorly.

Two other check ligaments are invariably found on all of the rectus muscles, although they have not been called by that name. Lancaster[3] described them as follows: "The rectus muscles are inserted into the sclera by tendons the length of which is about half the diameter of the cornea. The width of the insertion is about equal to the diameter of the cornea. But these tendons and insertions do not represent the whole method of attachment of the muscles to the eyeball. Both surfaces of each muscle are covered with a thin layer of connective tissue which is the capsule of Tenon. These layers blend or unite at the edge of the muscle and continue as a single layer to the edge of the next muscle where it splits to cover both surfaces of this muscle, and so on around the eyeball. When the tendon is cut at its insertion into the sclera, the muscle and tendon are not left

tus muscles has been called the *intermuscular membrane* and it is shown in Figure 5. The check ligaments are fascial extensions of the muscle sheaths. The intermuscular membrane is an extension of the muscle sheaths. The check ligaments insert primarily into the periorbita while the intermuscular membrane inserts into the sclera. Both the check ligaments and the intermuscular membrane serve as secondary attachments of the muscles, both are subdivisions of the fascia of Tenon, and both may exert a checking action on excursions of the globe. Jameson[4] described the checking action of the intermuscular membrane and this will be considered in some detail in a subsequent paragraph. Suffice it to say that both the check ligaments and the intermuscular membrane can be considered as *check ligaments.*

There are three points about the check

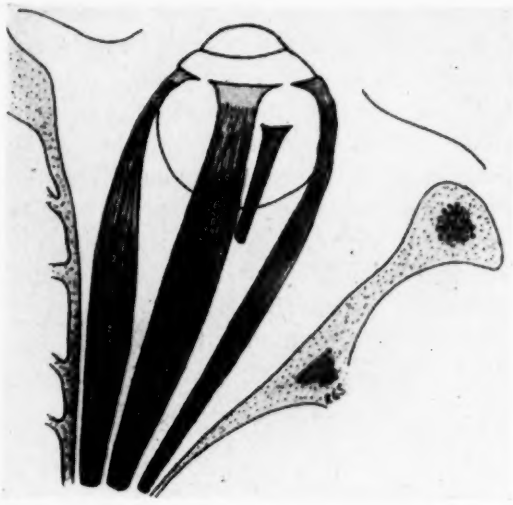

Fig. 6 (Scobee). Schematic diagram of the right eye as viewed from above showing the insertion of an abnormal muscle slip laterally and somewhat posteriorly. The slip appears to have arisen back in the orbit from the superior rectus but, since this is not certain, no definite origin is shown. A similar situation was found on the left eye of the patient mentioned in the text.

ligaments in heterotropia which must be emphasized:

(1) All anatomists have implied that any fascial expansion of the muscle sheaths are check ligaments. Therefore, the intermuscular membrane is a check ligament.

(2) The externally directed check ligaments, that is, those running to the orbital walls, are not a single fascial plane in the patient with heterotropia, but there may instead be several fanning out from each muscle sheath and running to the periorbita. In the case of esotropia, they fan out from the sheath of the medial rectus muscle.

(3) With but a single exception, all writers have pointed out that the check ligaments check *over-action* of the muscle from whose sheath they arise, but the fact that they may also *prevent adequate relaxation* when the antagonist of that same muscle contracts does not seem to be generally recognized at all.

Abnormal muscle slips

Abnormal muscle slips may either arise well back in the orbit and diverge slightly from the course of the rectus muscle which is their apparent source to become inserted into the globe at a point somewhat behind and to one side of the insertion of their parent muscle, or an abnormally large collection of muscle fibers will be found in the intermuscular membrane. The latter condition is by far the more common of the two. Abnormal muscle slips appear in association with the rectus muscles in the following order of frequency: (1) Superior rectus, (2) lateral rectus, (3) medial rectus, and (4) inferior rectus.

As an example of the first type—the abnormal slip inserted posterior to and to one side of the apparent muscle of origin—a 15-year-old girl with intermittent left hypertropia was subjected to two operations. At the first operation, the left superior rectus was receded to the equator. At the second operation, the left inferior rectus was resected some 4 mm. Neither procedure seemed to have any effect on the left hypertropia which became particularly evident in levoversion with the right eye fixing. At a third operation, the left superior rectus was severed from the globe and a muscle hook passed over the entire upper surface of the eyeball.

A muscle slip was hooked in this maneuver which seemed to arise from the superior rectus about half-way back in the orbit; it ran forward and slightly laterally to become inserted into the globe about 4-mm. lateral to the course of the left superior rectus and about 2-mm. anterior to the equator as shown in Figure 6. When the slip was sectioned and the left superior rectus reinserted in its receded position, the left hypertropia disappeared entirely.

A similar case was that of a 5-year-old boy with marked esotropia which appeared, according to the history, at about the age of one year. A slip which appeared to arise from the inferior border of the medial rectus was found and it was inserted below and about 4 mm. behind the normal inser-

tion of that muscle. Section of this slip corrected the deviation entirely and nothing was done to the medial rectus.

The second type of abnormal muscle slip —collections of muscle fibers running in the intermuscular membrane—is encountered much more frequently than the first type. The intermuscular membrane is normally thickest between the superior rectus and the lateral rectus. Not infrequently, patients with an apparent paresis of an inferior rectus and a consequent hypertropia on the same side are encountered. When the forced duction test is applied, definite resistance to infraduction is found in the eye in question. Surgical exploration will usually reveal what appears to be an abnormal and asymmetric insertion of the superior rectus; actually, the superior rectus has a normal insertion but a thick band of muscle fibers runs in the intermuscular membrane toward the lateral rectus and these fibers have a curving insertion into the sclera which extends laterally from the insertion of the superior rectus as shown in Figure 7. A small recession of the superior rectus plus sectioning of this lateral extension of the normal insertion is usually sufficient to correct the hypertropia entirely. Postoperatively, it is obvious that the inferior rectus was never paretic at all but that the abnormal muscle slip associated with the superior rectus prevented adequate relaxation of that muscle when its antagonist was contracting; naturally, the conclusion preoperatively was one of paresis of the inferior rectus.

In exotropia, it is not at all unusual to find an abnormally thick intermuscular membrane running between the lateral rectus and the inferior rectus and it often will contain abnormal bands of muscle fibers. Recession of the lateral rectus plus section of these fibers in their membrane is almost invariably sufficient to correct the deviation. And these abnormal bands, or merely the thickened intermuscular membrane without them, is sufficient to produce a definite feeling of resistance preoperatively when the forced duction test is applied. No resection or advancement of the medial rectus is necessary or even indicated in such cases, and yet they are often mistaken for paresis of a medial rectus and a so-called strengthening operation is performed on that muscle.

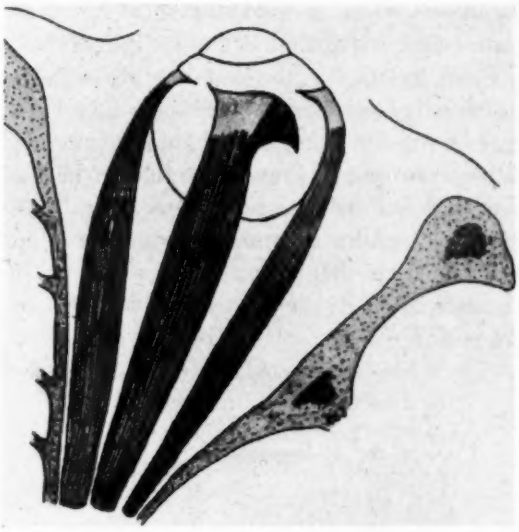

Fig. 7 (Scobee). Schematic diagram of the right eye as viewed from above and showing an abnormal insertion of the right superior rectus. The usual insertion is extended laterally and posteriorly in a curve and the extra insertion contains muscle fibers. Such an insertion is fairly common in patients with hypertropia with a preoperative diagnosis of paresis of an inferior rectus.

Abnormal insertions

At first glance, this category might seem to be an overlapping of the previous one. It is not, however, because what is meant by an abnormal insertion is a foot-plate type of insertion. The insertion line of the muscle at the usual distance from the limbus appears to be normal both in length and in direction. The intermuscular membrane is of normal thickness and contains no bands of muscle fibers. The check ligaments may appear to be perfectly normal.

When the linear insertion of the muscle is severed, however, the muscle will be found to be solidly attached to the globe backward from its linear insertion for a distance varying anywhere from 2 to 7 mm. This large,

broad insertion is solid—in short, a foot-plate—and is depicted in Figure 8.

Prior to surgery, the heterotropia in these cases is often erroneously attributed to paresis of, for example, a lateral rectus because esotropia is present, abduction of the eye is definitely limited, and fixation with that eye results in greater esotropia than fixation with the opposite eye. The latter point is strongly suggestive, of course, of

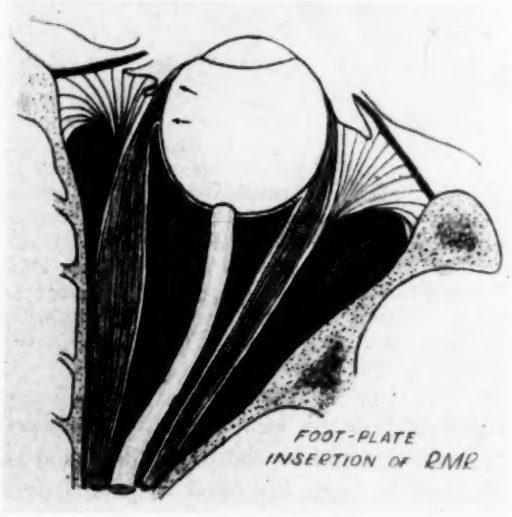

Fig. 8 (Scobee). Diagram of the right eye viewed from above and showing a foot-plate insertion of the right medial rectus. The right lateral rectus has a normal insertion. This solid insertion extends backward about 6 mm. from the normal linear insertion.

primary and secondary deviation following paresis. Indeed it is primary and secondary deviation although it is doubtful that paresis, at least in the usual sense of the word, had anything to do with the origin of the deviation. A muscle that is so attached is usually normal in size and elasticity.

Occasionally one finds such a muscle that has lost some of its elasticity and has apparently become contracted or perhaps even slightly fibrotic; this could well be due to its inability to relax properly over a long period of time when its antagonist contracted. After all, when an agonist is paretic, it is a commonly accepted idea that its antagonist may become contracted and even fibrotic for these same reasons. The presence of such a broad foot-plate insertion is invariably revealed preoperatively in the form of resistance to free rotation of the globe in the forced duction test applied under general anesthesia.

The forced duction test

When the patient with heterotropia is placed under general anesthesia, the tonus of all of the voluntary musculature of the body is markedly reduced. With respect to the oculorotary muscles, this means that they should all relax to the point where forced rotation of the globe in any direction, produced by placing a muscle hook in the conjunctival fornix and depressing it, should be free and easy. In at least 90 percent of all patients with heterotropia which became evident before the age of six years, forced ductions are not free and easy in all directions.

If a patient has esotropia, for example, and under general anesthesia the surgeon forcibly rotates first one and then the other eye outward (in forced abduction) by depressing the lateral conjunctival fornix with a muscle hook, unequal or at least increased resistance of the forced duction will be encountered on the two sides in 90 percent of the patients whose deviation appeared before the age of six years. In addition, the eye offering the greatest resistance to this forced abduction will also often be noted to retract.

When one explores the check ligaments and other attachments of the medial rectus of that eye, almost invariably the cause of the resistance to forced abduction and frequent retraction of the eye will be found. It seems obvious that the retraction is the same, at least on mechanical grounds, as that seen in Duane's retraction syndrome, and is indicative of inability of the medial rectus muscle of that eye to relax adequately

for one reason or another when its antagonist contracts.

O'Connor[5] is certain that the antagonist of a paretic muscle will become contracted before the expiration of the usual one-year waiting period following development of the paresis. He employs a procedure somewhat similar to the forced duction test but with the object of determining whether or not contracture has developed in the antagonist of a paretic muscle. His plan, however, is that of grasping the tendon of the suspected muscle through the conjunctiva with a fixation forceps, the eye having been anesthetized, and exerting traction. If either undue resistance is felt or the eye cannot be rotated through a normal excursion, O'Connor quite justifiably assumes that contracture is present. If one judges correctly from his papers on the subject, he only applies this test to patients with relatively recent paresis and then only in an attempt to determine the time of onset of contracture of the antagonist in order to select the proper time for surgical interference.

The forced duction test can be quickly and easily carried out prior to the beginning of an operation and will yield invaluable information. Its practical application will perhaps be more evident if a few illustrative and typical cases are cited.

A 4-year-old boy who had developed marked alternating esotropia at the age of three had no difference in the angle of deviation with either eye fixing. All available tests indicated what appeared to be a truly concomitant heterotropia. The angle of the deviation measured 25 degrees. Under general anesthesia, marked resistance to abduction was encountered in the left eye with the forced duction test. Surgical exploration of the left medial rectus revealed a fused type of check ligament. This was sectioned and the muscle receded to the equators. The result was 25 degrees of correction and the patient had good second-degree fusion within four months following the operation.

Another patient was a 5½-year-old girl with right esotropia which had become apparent at about three years of age. The deviation measured 32 degrees without her glasses and decreased to 20 degrees with glasses. Her correcting lenses were: +4.0D. sph. ⊂ +0.50D. cyl. ax. 90° in each eye. Voluntary abduction of the right eye was subnormal. The preoperative diaghosis was one of mild paresis of the right lateral rectus. Forced duction tests under general anesthesia elicited definite resistance of the right eye to abduction. The right medial rectus was explored and found to have five large check ligaments fanning out from the muscle sheath to the periorbita. These were sectioned and the muscle was found to be of normal size and elasticity; the muscle was receded 4 mm. The result was 22 degrees of correction. The plus spheres were slightly weakened and the patient soon developed fusion.

Patients with intermittent heterotropia have been the most difficult and unsatisfactory to classify in the past. These are the patients who have relatively high degrees of heterophoria and who lapse into heterotropia with fatigue or any undue usage of the eyes. The patient with between 20 and 30 prism diopters of exophoria who goes into frank exotropia with fatigue is a good example. Careful examination reveals only what appears to be convergence insufficiency or "divergence excess." The deviation, when elicited, is the same with either eye fixing. And yet forced ductions will almost invariably reveal increased resistance to adduction in both eyes, often unequal on the two sides. Surgical exploration of the lateral recti will usually reveal large check ligaments, particularly in that portion of the intermuscular membrane running downward to the inferior rectus. Often enough, this thickened membrane between lateral and inferior rectus will contain a band of muscle fibers. These abnormal bands have already been discussed as abnormal muscle slips. Section of all check ligaments and bands and

recession of the muscle are all that is needed if the deviation be not too great. If it is great, both lateral recti must be receded.

Dealing with anatomic factors

One might inquire as to why simple division of the abnormal attachments previously described should not be enough to correct the deviation, provided they were responsible for the deviation originally. In the first place, check ligaments acting in two directions can prevent adequate relaxation as well as over-contraction and thus lead to some degree of loss of elasticity, even to contracture and fibrosis in a muscle. Certainly it is not reasonable to expect that correction of the anatomic anomaly alone will correct the heterotropia in the face of the subsequent changes—that is, loss of elasticity, contracture, and fibrosis—which have occurred. In the second place, there may have been other etiologic factors in addition to the anatomic one.

Consider the patient with esotropia which appeared at about the age of three years. The eyes and the orbits are markedly divergent before birth, become less so at birth, and as the skull and its contained structures grow in infancy and childhood, the tension on the anatomic anomaly in the attachment of the medial rectus increases. This would mean that the position of rest in such a patient would be one of less-than-normal divergence at birth and one of decreasing divergence as growth proceeded. Meanwhile the growing child is discovering his developing powers of visual acuity and of accommodation. As he begins to see objects more clearly, he begins to attempt and to succeed in exerting more and more accommodation with its associated convergence. We have seen how the position of rest in such a patient instead of being one of frank divergence is one of little or no divergence—almost parallelism; furthermore, full abduction is impossible because of the anchoring effect of the anatomic anomaly on the medial rectus. The exercise of accommodation and convergence, when beginning from a position of rest of near-parallelism, is sufficient to produce frank esotropia. And this would be true *irrespective of the refractive error of the individual,* as long as anatomic anomalies were present either in the check ligaments, the muscle insertions, and so forth.

Hypermetropia is considered by many as a developmental anomaly in that the hypermetropic eye is usually a small eye, presumably one whose growth was arrested before attaining emmetropia. Abnormal anatomic attachments of the muscles are certainly developmental anomalies. The finding of one anomaly frequently means that others are present. This, then, is a possible explanation for the frequent association of hypermetropia with esotropia. However, the refractive error need make no difference, and esotropia in the myopic infant can also be explained on the basis of an anatomic anomaly; the same is true for anisometropia.

It does not seem likely that the majority of anatomic anomalies described in the muscle attachments could be sufficient in themselves alone to produce heterotropia except in such rare instances as strabismus fixus. However, the addition of the accommodation-convergence relationship, for one thing, can act as a precipitating factor in producing the deviation. Thus it is that a majority of cases of heterotropia have a definite and demonstrable accommodative element but almost invariably there can be demonstrated some underlying anatomic defect; otherwise the eyes would never have deviated in the first place except in a few instances.

When one operates on patients with paretic heterotropia of recent origin, these anatomic anomalies—that is, abnormal check ligament, abnormal muscle slips, abnormal insertions—are not found. And when one dissects the nonheterotropic cadaver orbit, these anatomic anomalies are not commonly found. They occur only in patients with heterotropia or with marked degrees of heterophoria. Surely their almost invariable

presence in patients with heterotropia and their invariable absence in patients without heterotropia is significant.

It does not seem likely that the existence of heterotropia could result in changes in the fascia of the check ligaments, and certainly it could not cause the development of abnormal muscle slips and abnormal insertions. Such an idea has been considered before, however, because Jameson[4] wrote:

"I think that it is not exceeding rational reasoning to consider that any eye deflected for many years acquires fascial contractions conforming to the fixed position of the globe in which the capsule (he refers to the intermuscular membrane) is an important part, and it is still within reason that a check ligament not called on to perform its function of a shock deterrent on the opposing side for a number of years may lose some of its elasticity and capability of stretching and assuming contractility, and may act as a deterrent to outward rotation."

One cannot disagree with Jameson on factual grounds about the patient who has had esotropia for 20 years; definite argument can be raised, however, about the child patient whose esotropia did not appear until the age of three years and who is subjected to surgery within 3 or 4 months after the deviation appeared because the same anatomic anomalies are found in the 3½-year-old child as in the 23-year-old adult patient.

The conclusion is therefore thrust upon us that the anatomic abnormalities preceded the heterotropia in point of time and that the heterotropia is at least partly due to these anatomic findings which have been described.

Method of inspection

The technique of searching for the anomalies described is simplicity itself and yet is followed by only a few. The muscle toward which suspicion is directed by the forced duction test, as well as by examinations preoperatively, is exposed on a muscle hook. A double-armed suture is placed through the tendon as close to the insertion as possible, the suture locked, and the tendon then severed from its insertion. Traction is made on the severed muscle by means of the double-armed suture and the muscle is pulled first away from the globe. This maneuver enables the operator to see whether or not a foot-plate type of insertion is present; if found, it may be divided.

The muscle is next pulled forward and toward the globe and the lips of the conjunctival incision are held apart by an assistant using forceps; the external check ligaments are thus put on a stretch and may not only be visualized but sectioned with scissors. It is to be emphasized that this is not a procedure of stripping the muscle of its sheath (to which there are serious and valid objections) but merely one of cutting the fascial extensions from the muscle sheath; no bare muscle is exposed. The check ligaments should be sectioned as far posteriorly as they may extend. If visibility is not good as one goes backward into the orbit with the inspection, a muscle hook can be passed gently backward along the orbital or external surface of the muscle. The check ligaments are not properly severed until this hook can be passed well beyond the posterior pole of the globe without encountering resistance.

Finally, in the case of the medial rectus, the muscle is pulled first upward and then downward in order that the intermuscular membrane can be inspected for thickness and the presence of abnormal muscle slips; the membrane should then be sectioned parallel to the borders of the muscle and a millimeter or so away from it, as shown in Figures 9 and 10.

When all anatomic anomalies of attachment are properly and completely sectioned, the muscle will usually retract promptly out of sight into the orbit when the tension on the muscle suture previously placed in the tendon is released. Once the muscle is thus freed, one may estimate its elasticity because this has an important bearing upon the amount of recession to be performed. As

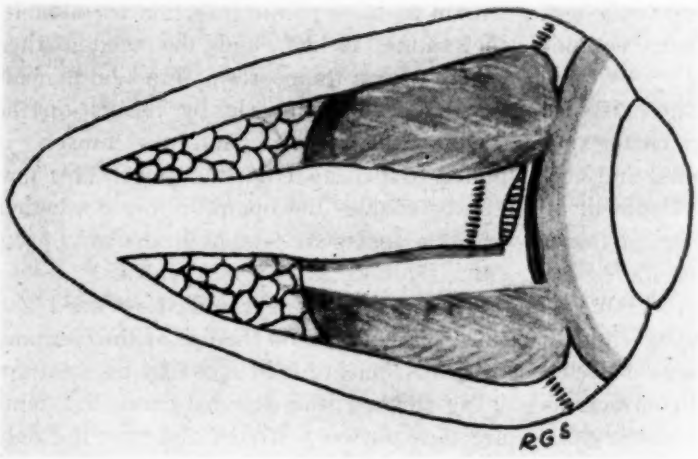

Fig. 9 (Scobee). View of the left eye from the medial surface showing the left medial rectus severed from the globe and the intermuscular membrane sectioned parallel to the lower margin of the muscle. Sclera is visible where the muscle has retracted and the intermuscular membrane pulled aside.

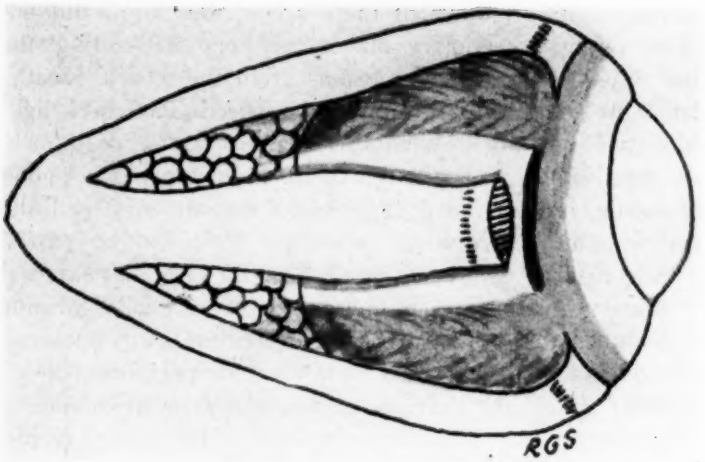

Fig. 10 (Scobee). The procedure of sectioning the intermuscular membrane (begun in Figure 9) has been completed. The muscle is now freed completely both superiorly and inferiorly. The other check ligaments are not shown.

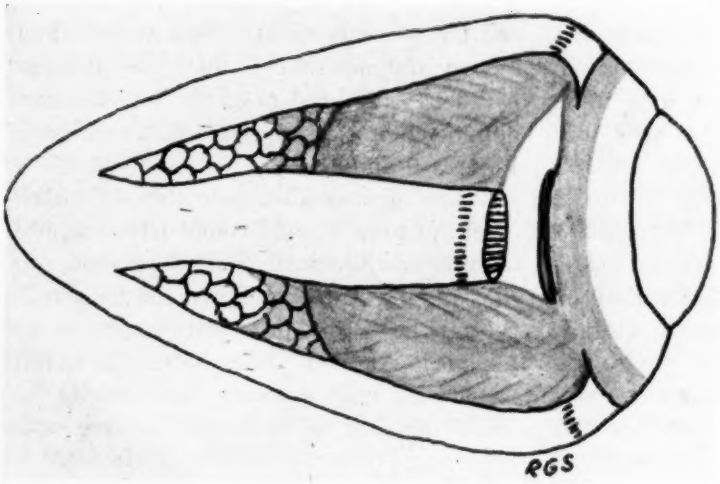

Fig. 11 (Scobee). The left eye viewed from the medial surface and illustrating Jameson's method of cutting the intermuscular membrane vertically. The left medial rectus has been severed from its insertion and a vertical cut started in the intermuscular membrane running upward toward the superior rectus. Jameson advised making a similar cut below toward the inferior rectus.

a final step, a muscle hook should be swept over the portion of the globe involved in a search for any abnormal muscle slips attached behind and to one side of the muscle under inspection.

The check ligaments should always be divided by sharp dissection, that is, with scissors, and never by blunt dissection as by tearing them with a muscle hook forced along the muscle edges because the latter procedure rarely severs all of the check ligaments, often tears the sheath from the muscle leaving bare fibers exposed, and almost invariably leads to the formation of troublesome adhesions which may partially negate the effect of the operation. When the muscle is properly freed, it may then be reinserted at whatever site is desired and the conjunctiva closed.

Objections to sectioning check ligaments

Many surgeons raise objections to any suggestion of cutting the check ligaments in the manner described in previous paragraphs. When pressed for reasons for their objections, a vague reference to retraction of the caruncle is the usual answer. Jameson[4] was one of the most prominent to counsel avoidance of the check ligaments and he, apparently, was also saddled by the bogey of "retraction of the caruncle." In speaking of his recession operation, he wrote ". . . the semilunar conjunctiva is also undermined in the direction of the caruncle, with care not to disturb the fascial trabeculae or areolar tissue on the surface of the muscle." And ". . . the areolar tissue in which the muscle is deeply imbedded in the region of the caruncle should not be sliced. If this is done, the muscle is endangered, the anatomy disarranged, and the reaction will be greater." And yet Jameson was the first exponent of complete division of the intermuscular membrane and he cut it vertically as shown in Figure 11. When first reporting his operation in 1922, he cautiously wrote that ". . . there has been but slight retraction of the caruncle and that difficult to distinguish and of negligible quantity." After 10 years of experience with his operation, he confidently reported in 1931[6] that ". . . it has been most noticeable that no caruncular retraction or inversion has occurred."

It will be recalled that some of the worst instances of retraction of the caruncle followed free tenotomy of the medial rectus. When one considers the anatomy, the reason is obvious. The medial rectus is attached by means of its check ligaments to the caruncle. When a free tenotomy is done, the muscle naturally retracts somewhat, tensing its check ligaments, and retracting the caruncle. On theoretic grounds, one would expect less retraction of the caruncle when the check ligaments are severed than when a recession is done and they are left intact. This is adequately borne out in a series of over 120 patients in whom the check ligaments of the medial rectus were completely divided by the technique previously described and not a single patient had a retracted caruncle.

It is difficult to see how Jameson could claim that sectioning the check ligaments would "disarrange the anatomy" any more than his free vertical sectioning of the intermuscular membrane. And he would have come much closer to the truth, perhaps, if he had not avoided them. He wrote[6] that ". . . even after this vertical capsulotomy is accomplished, forcible traction meets with obstruction to rotation in a few cases. The reasons are hard to fathom when both muscle and capsule are freed." The reasons would not have been difficult to fathom if he had not so religiously avoided the check ligaments!

One cannot admire Jameson enough for his forthright and scientific studies of the role of the intermuscular membrane in the etiology of heterotropia. He was one of the first to make the point that no final decision as to what surgery should be done could be made until the muscles were exposed at the time of operation. He wrote that ". . . when

exposure yields information that runs counter to the preoperative computation, one can close the wound and proceed on the opposing side." He was among the first to point out that a muscle might appear to be paretic when actually the true situation was anatomic abnormalities on the direct antagonist; section of these abnormal attachments, of course, led to complete "restoration" of function in the "paretic" muscle.

Esotropia, being more common than exotropia in young patients, will yield to recession of one or both medial recti in the majority of cases, *provided one carefully sections all abnormal attachments of the medial recti* and provided the medial recti are not too inelastic as a result of their inability to relax adequately; if they are inelastic, a shortening procedure may be necessary on one or both lateral recti in addition to recession of both medial recti. A deviation of 20 degrees in one patient and of 30 degrees in another may yield to recession of a single medial rectus *if* that muscle's abnormal attachments are severed. This is far more correction than might be expected with mathematical computation but is easily explainable in view of the anatomic anomalies encountered.

The writer does not ask the reader to accept without question these ideas which are presented, and indeed there will probably be few who will be so inclined. If the reader will, however, apply the forced duction test prior to operation and then carry out a search for anatomic anomalies as described, it is believed that the results will speak for themselves and that the individual operator will convince himself.

A classification of heterotropia

The statement has been made that 90 percent of all patients with heterotropia which developed before the age of six years have some anatomic anomaly underlying their heterotropia.

If the foregoing views are acceptable, or are found to be so at a later date, one may then elaborate what may perhaps be a more satisfactory classification of heterotropia. There would still be three main categories. (Monocular or alternating—exo-, eso-, hyper-, cyclo-).

A. Anatomic

1. Abnormal origins of muscles
2. Abnormal insertions
3. Abnormal muscle slips
4. Abnormal check ligaments
5. Abiotrophies

B. Innervational

1. Nervous (anomalies of convergence and divergence)*
2. Refractive (accommodative)*
3. Amblyopic (any organic obstacle to fusion)

C. Paretic

1. Toxic
2. Traumatic
3. Congenital

It will be noted that "a weak fusion faculty" or a "defect of the fusion faculty" has been omitted entirely in the classification and this is a radical departure from custom. The fusion mechanism is a well-recognized entity although it has never been demonstrated anatomically. It seems to attain its full development at about the age of six years, on the average. In the opinion of many, the fusion faculty is inherited just as brown eyes are inherited; it is said to be possible for a parent with a "weak fusion faculty" to pass on this defect to his or her offspring, and this is one explanation offered for the definite familial incidence of heterotropia. Chavasse[1] typifies the opposite view when he said ". . . we need no longer vainly gesticulate before the fireless altar of defect of the fusion faculty any more than we need to be content to regard lameness (with which strabismus has so

* This is frequently found superimposed upon some anatomic factor.

much in common) as a defect of the walking faculty."

It is believed that a careful search for anatomic abnormalities in every patient with heterotropia in every case that comes to surgery will soon convince the surgeon that Chavasse was right. Truly the role of anatomic abnormalities in heterotropia makes that entity very similar to lameness which is usually due to organic causes. One wonders if we have not been mentally lazy in the past and willing to speak of many cases as being due to a defect of the fusion faculty when a more thorough search would have revealed a more easily demonstrable and hence more acceptable cause for the deviation.

It is much easier to accept the idea of the inheritance of some anatomic abnormality from the parents, a common and well-recognized occurrence, rather than the inheritance of a weak fusion faculty. Anatomic abnormalities can be demonstrated in both parent and child while a defect of the fusion faculty is a nebulous entity whose existence can be shown only by inference.

In conclusion, one might well ask the value of such a classification to the clinician, even if he is willing to accept it. The answer is that it will lead to a far more successful therapy of heterotropia. The so-called "strengthening" operations alone will have nothing to recommend them except as they are used in conjunction with the recession. Cases of esotropia in children, for example, which appear to be due to a unilateral or a bilateral paresis of the sixth cranial nerve, may well be found to be due to abnormal check ligaments on the medial rectus muscles instead (as indeed so many of them are) which prevent adequate abduction of the eyes. The futility of trying to "strengthen" an apparently paretic lateral rectus when in reality the difficulty lies in a group of abnormal check ligaments or some other anatomic anomaly on the direct antagonist, that is, the medial rectus, should be obvious. One might as well double or triple the number of tugs used in an attempt to move the *Queen Mary* away from the dock when her anchoring shore-lines have never been cast off.

Lancaster[3] wrote that ". . . the two things for which we strive in operating are a position of orthophoria since, other things being equal, the nearer the eyes to a position of orthophoria, the less the task of the neuromuscular mechanism in maintaining binocular vision. Second, an effective range of fusion, this being, if possible, even more important than the former. A neuromuscular mechanism which, because of defective working of the controls, produces an exophoria, for example, may be made to produce an orthophoria by so shifting the position of the eyes in the orbit that approximately the same working of the controls will now result in orthophoria because the eyes start from a position nearer to the ideal one. *The idea that the purpose of operating on the ocular muscles is to weaken or strengthen some muscle which is too strong or too weak is unsound physiologically* (italics my own)."

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REVIEW OF 100 CASES OF RETINAL DETACHMENT*

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This paper is an analysis of 100 consecutive cases of idiopathic retinal detachment examined between January, 1945, and October, 1946, operated on with the electrodiathermy technique, and subsequently followed by us. Excluded in this series were 3 Linder underminings, 4 scleral resections done on aphakics, and 6 scleral resections done as a primary procedure by us on patients who had had previous diathermy operations. With the realization that 100 cases is an insufficient number on which to base any definite statistical conclusions, the figures herein presented serve to emphasize certain important features of retinal-detachment work. Inasmuch as the adverse outcome of an untreated case is well known, surgery was not denied anyone if they wished it, regardless of the appearance, duration, or apparent hopelessness of the case.

INITIAL EXAMINATION

Initial examination included vision tests, external examination, measurement of tension with the Schiøtz tonometer, slitlamp observation with dilated pupil, and inspection of the vitreous with the contact lens and slitlamp (Linder's offset corneal microscope). Perimetric fields were done with the smallest isotope visible to the patient.

Extremely careful fundus study and search for a retinal tear or tears was made with a sketch of the fundus diagraming the extent and elevation of the detachment. We have frequently found that, while tracing the retinal vessels and their branches, a tear may be located which has escaped notice in an overall fundus examination. The careful search for and localization of retinal tears cannot be overemphasized, since successful reattachment depends on closure or sealing of these tears.

FINDING TEARS

In regard to finding tears it must be remembered that a tear is not necessarily in the area of greatest detachment especially in those cases where the separation begins superiorly. Here the subretinal fluid gravitates inferiorly, and the tear may be found in a flat or apparently attached area of the retina. If a tear is not found at the first examination it may be hidden by an overhanging edge of the retina or in a deep fold, but when the retina settles back toward normal position following bed rest with binocular bandages, the tear may be revealed. Contradictorily, when the retina settles back the tears previously seen are often difficult to see because they become displaced far into the periphery or may not stand out because of the lack of color contrast.

When no tear has been found and the detachment settles out after several days of bed rest, the patient may be allowed to get up or to wear peephole glasses. Repeated examination may then show where the detachment reappears giving either a clue as to the location of the tear or the actual finding of it. A clue may also be obtained from the history as to where the detachment has commenced, and hence where the tear exists, if the patient noticed the location of the appearing shadow or curtain.

The tears are localized carefully with the hand perimeter as to arc and meridian. An arc of 50 degrees is considered to be 15 mm.

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posterior to the limbus, and each 5 degrees of arc is equal to approximately one millimeter.

Surgical Management

Surgical management has been conducted in a similar way in these 100 cases. Preoperatively both eyes are bandaged, and the patient put at absolute bed rest in a position so that the retinal tear is in the most dependent part of the eye. In approximately half the cases, the retina had settled back markedly after this period of four or five days rest. No change was noted in 15 cases, and there were three cases in which the detachment increased in extent.

Surgery was done under local or combined local and avertin anesthesia. The horizontal meridian of the eye was marked at the limbus prior to the retrobulbar injection. The conjunctiva was incised 8 mm. from the limbus and, with Tenon's capsule, was separated from the sclera posteriorly.

Traction sutures were placed in the conjunctiva, and sling sutures through the muscle insertions to obtain better rotation. There was no hesitation in tenotomizing one or even two muscles to assure adequate exposure. The cornea was kept moist with normal saline, but covering it with the lid into which a traction suture had been placed was found to keep the cornea clearer than saline, glycerine, or other agents that have been recommended for this purpose.

The tear was localized directly with the ophthalmoscope (which is conveniently draped so as to be ready for use at all times), using an Arruga spoon and gentian violet to mark the relative position of the tear as it corresponded to the scleral surface. Rarely did the preoperative localization have to be transferred to the Walker rule and Linder dial for mathematical localization.

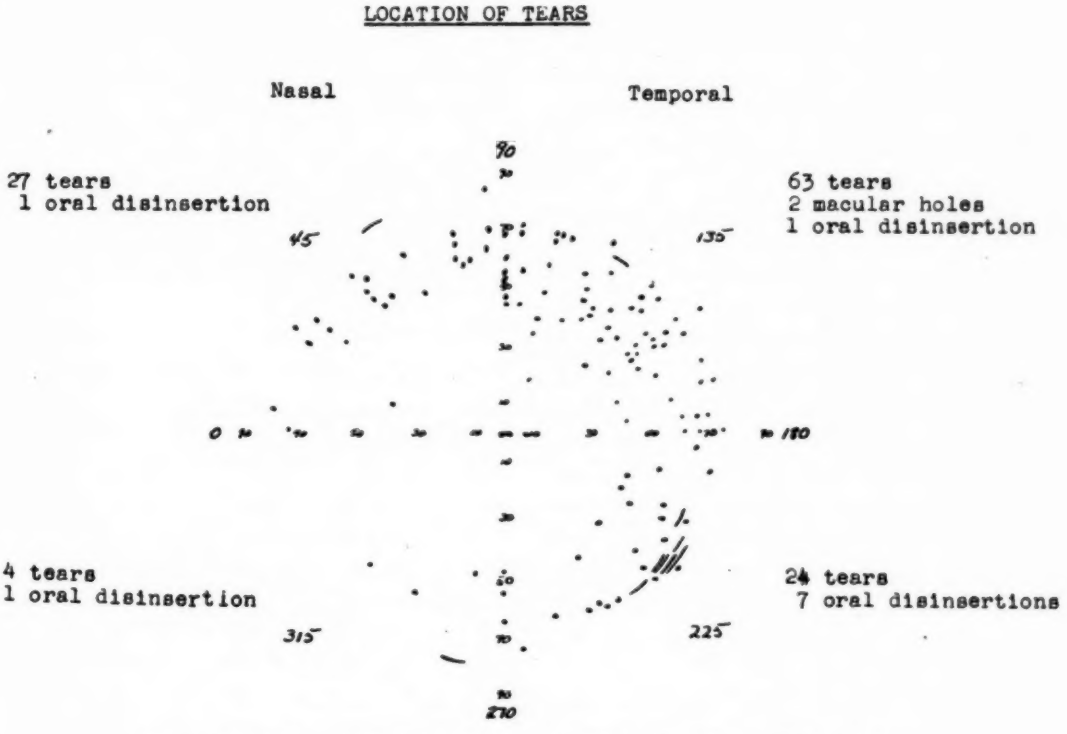

Fig. 1 (Appleby and Pischel). The location of tears in the present study was in agreement with the findings of other authors.

Partial penetrating Pischel electrodes and the Rose Walker diathermy machine were used, employing 50 milliamperes for 2 to 3 seconds. Two or three spots of diathermy were placed 1 to 2 mm. behind the localized tear, and the fundus was examined to see where these were in actual relation to the tear.

These spots usually showed well in the fundus, but if the retina was so elevated that they were not visible, a Pischel pin was inserted over the localized area on the sclera (done in 37 of these cases). This pin was almost invariably easily seen and served as an accurate guide to the location of the diathermy coagulations, assuring complete surrounding of the tear.

A double row of coagulations was placed about the tear coming up to the ora serrata (8 mm. in emmetropes, and 9 mm. in high myopes). Cystic areas were likewise included. Pischel pins (usually 9 to 12 of them) were inserted *within* the loop of diathermy barrage for drainage. Very frequently these pins could be seen to perforate the retina; therefore, it was decided that these newly formed retinal holes should be within the diathermy loop resulting in their being sealed also.

Occasionally, if no drainage was obtained from the pin openings, perforating electrodes or trephine openings were used. Frequently considerable more subretinal fluid could be aspirated from these openings in the sclera. In only 10 cases was air injected into the vitreous chamber to push the retina toward the choroid.

Postoperative care

The patients were kept in bed with binocular bandages for two weeks. The first of daily dressings was done on the second postoperative day, and stitches were removed the 7th to 10th day. The fundus was not examined until the 7th to 10th day. After 14 days, peephole glasses were substituted for bandages, and these were worn for an additional six weeks, with the patients' activities limited. During this period, the pupil was kept dilated with atropine or scopolamine.

Statistical analysis

Age and sex

Of the 100 cases analyzed 58 percent occurred in males, and 42 percent in females. Berens'[1] figures, 63 percent and 37 percent respectively, correspond closely to those reported by others, and the predominance shown by men has been explained by their predilection to trauma. In this series, 57 left eyes and 43 right eyes were affected, and in 13 cases both eyes had developed detachments; the time interval of involvement of the second eye varied between 5 months and 18 years. The maximum number of detachments occurred in patients aged between 60 and 65 years, but the average age for the entire series of cases was 49.5 years.

Refractive error

Myopia existed in 56 percent (31 cases 0.0D to −3.0D., 13 cases −3.0D. to −6.0D., 8 cases −6.0D. to −9.0D., the highest being −17.0D.); while 25 percent occurred in hyperopes (22 cases 0.0D. to +3.0D., the highest being +4.25D.). There was no record on the remaining cases. (Dunnington and Macnie[2] reported myopia existing in 53.8 percent and 66.6 percent of retinal detachments; Berens, in 68 percent; Shapland,[3] in 62.3 percent and Hine,[4] in 40 percent).

Precipitating factors

Of our patients, 43 percent gave a definite history of trauma which was believed to be the precipitating factor in producing the detachment. Seven of these were a direct blow on the eye, the remainder being indirect trauma such as a bump on the head, a hard fall, or heavy lifting. In three cases severe coughing and sneezing were implicated. Thirteen percent of the patients could recall no such trauma, and no history of trauma was recorded in 40 percent of the cases. It is of interest to note the time inter-

val between the so-called trauma and appearance of symptoms, as this is a frequent problem in establishing etiology.

We found it to be as follows:

60-90 days	6 cases
30-59 days	7 cases
14-29 days	2 cases
7-13 days	3 cases
1-6 days	13 cases

Symptoms

The most common presenting symptom was a shadow or curtain coming across the eye. This was noted by 44 patients; black spots or floaters by 31 (these are believed to be caused by slight hemorrhage into the vitreous from a ruptured blood vessel in the region of the retinal tear); flashes of light (resulting from mechanical stimulation of the retina) were noted by 14; and 39 complained only of blurred vision. Eight cases had been previously diagnosed as vitreous hemorrhage.

Parenthetically, it should be emphasized that all patients complaining of the sudden appearance of black spots before their eyes should be carefully examined for the presence of a retinal tear. Peripheral fields must be done and the examination repeated if nothing is found at the first examination. Arruga has 47 cases of retinal holes without detachment, and it is probably true that many more exist in those who do not consult a physician because of passing photopsia or black spots.

In this series, only one patient who had previously had a detachment in one eye noted black spots and flashes in the other. Several small holes were found in the periphery but no detachment developed (followed 10 months).

Retinal tears

Retinal tears were found in 88 percent of the cases, while in the remaining 12 percent no tear could be found. This is considerably higher than reported by others (Berens, 29 percent; Dunnington and Macnie, 56 percent; Shapland, 76.2 percent; and Meyer,[5] 57 percent) with the exception of Hine who in 120 cases found no retinal tear in only six cases. As Meyer pointed out, tears can usually be found if the ophthalmologist exercises sufficient care in his examination. We do not agree with those who believe that the finding of a retinal tear is unimportant in obtaining a reattachment. The mechanism of a detachment need only be considered to realize the necessity of finding and sealing off the tear in the retina to assure success.

The horseshoe-shaped tear was most common, occurring in 58 percent of the cases. Round holes were found in 33 percent, macular holes in 2 percent, linear and oval holes, each 7 percent, irregular rents in 5 percent, crescent shaped in 3 percent, and oral disinsertions in 10 percent. Multiple holes were found in 27 percent (2 to 8 tears). The location of tears can be seen in Figure 1 and is in agreement with the finding of others. Tremendous tears or large multiple tears decrease the chance of successful reattachment, but beyond this there was no relation to the type of tear and cures.

Type of detachments

We found that 35 percent of the detachments were classified as bullous in type, 33 percent as flat, and 32 percent as combined bullous and flat. A total detachment existed in 21 of the cases, 15 of which were cured despite the general opinion that these cases are hopeless. In 5 cases over three fourths of the retina was detached; in 12, three fourths was involved; in 36, one half; in 21, one fourth; and in 6 cases, the extent of the detachment involved less than one fourth of the retina, or was limited to the area of the tear. Comparison of the above findings with final results shows that the chance of surgical success is greater, the less the extent of the detachment. How-

ever, a detachment of total or marked extent should certainly not be disregarded nor considered hopeless.

Duration of detachment

The duration of a retinal detachment is difficult to determine and, in this series, was based only on the time of onset of symptoms regardless of the appearance of the retina. In this series, this time varied between one day and 11 years (the latter diagnosed by two ophthalmologists). The duration of the detachment is of importance in prognosis for anatomic and functional success. From Table 1 it may be seen that if the detachment had existed less than two months the chance of success was definitely enhanced. If the duration of the detachment was two months or over, the number of unsuccessful cases markedly increased. This bears out the necessity of treating cases of retinal detachment as emergencies, hospitalizing them immediately, and operating as soon as the retina has settled back toward normal position. This was usually found to be accomplished with 4 to 5 days of bed rest with binocular bandages.

TABLE 1

Duration of detachment

Duration in Months	Number of Cases	Number of Cases Unsuccessful
0 to 1	47	3 or 6.38%
1 to 2	11	1 or 9.09%
2 to 3	9	3 or 33.3 %
Over 3	23	5 or 21.7 %

Incidence of vitreous detachment

In 35 cases a posterior vitreous detachment was discerned with the contact lens and slitlamp, using Linder's offset corneal microscope; and in 6 cases no detachment was found; while in 9, the vitreous was noted as completely disorganized. Of the remaining 50 cases, there was no note of vitreous detachment. In this respect it must be remembered that no group of normal eyes was examined for comparison.

Complications

Out of the 100 patients, 6 had complications attributable to the retinal detachment. Four of these had iridocyclitis (2 inactive), and two had a tension of 40 mm. Hg (Schiøtz). One of the cases of increased ocular tension was controlled by eserine and pilocarpine in three days, following which mydriasis did not result in any elevation. In the other case a cyclodialysis was necessary to control the tension.

Criterion for success

The criterion for success in these 100 cases was based only upon permanent reattachment of the retina, regardless of the resultant visual acuity or peripheral field. With this as a basis, 86 percent of the cases were cured. It should again be mentioned that this series is not large, and that it was perhaps fortunate that we saw few bad cases in the time interval considered. With the inclusion of all detachment cases operated on by us during the period under consideration (Linder underminings, and scleral resections), 80.5 percent were cured.

A second diathermy operation to obtain reattachment was done on 15 eyes, 10 of which were successful. Two of the successes were on eyes that developed a second retinal tear and detachment completely isolated from the first. Six patients had been operated by diathermy elsewhere, two of whom had undergone two operations. These two and three of the others were cured.

In successful cases, an apparent reattachment is the usual finding at the time of discharge from the hospital. However, in five cases the detachment of the retina was still present at this time, only to become reattached within 4 to 6 weeks. Of those apparently successful, one became detached in the operated area after six months following a severe coughing and sneezing spell. This was an 83-year-old patient who refused fur-

ther surgery, and is listed as a failure. One other retina remained attached 1½ months and at the time, due to an unexplained cause suffered a practically complete detachment which increased in extent in spite of bed rest with binocular bandages. The two other cases of redetachment occurred after two months and 2½ weeks and were cured by reoperation.

Postoperative complications

Postoperative complications were minimal. One patient had a severe iridocyclitis which cleared with typhoid-fever therapy; another one had a hyphemia, while a 44-year-old woman became hysterical and had to be transferred to the psychiatric service (all failures).

One patient became so disoriented that she was allowed up with peephole glasses for the first three postoperative days, after which the routine was carried out in full (cure). Two others had small vitreous hemorrhages immediately following surgery (cures).

In no cured case was any change noted in the lens. It has been stated above that recti muscles were tenotomized without hesitation to assure adequate exposure. In those cases where the horizontal muscles were cut from their insertions, no important change in muscle balance has been noted. Of the vertical muscles tenotomized 9 cases showed a hypophoria, with 3 requiring prismatic correction for comfort. A hyperphoria resulted in 24 cases, requiring prism correction in 5; while 7 had orthophoria. In 12 cases, muscle balance was impossible to obtain, and in 7 none was recorded. In those cases where the muscle had not been cut, equal degrees of hypophoria and hyperphoria resulted, but in no case was it sufficient to be annoying to the patient.

In 49 cases, the retina was seen to recede toward the choroid to a considerable extent after drainage of subretinal fluid; moderately in 17; slight in 19; and no change was noted in 15. This had no apparent effect on the final outcome. Air was injected in 10 cases, and trephine openings were made in six.

Perimetric fields

Perimetric fields are taken at each postoperative visit at one-third meter distance with a 1-mm. test object (rarely 3 mm.). The immediate result in those cured cases was a return to a normal, or an almost normal, peripheral field, except in 13 cases. Twelve cases showed a constriction corresponding to the area of operation, and two were concentrically constricted. The only cases showing any gradual improvement of field were those five mentioned previously in which the retina became reattached over a period of time. Late loss of field was noted in four patients. In the first two, the loss was limited to the area of operation after six months and one year had elapsed, respectively. The third showed a shrinkage of field similar to that prior to surgery, and the fourth developed a concentric constriction of 20 degrees in five months. There was no relation between the duration of the detachment and the maintenance of peripheral vision or the late loss of it.

Visual results

The overall visual results may be seen in Table 2. In our 100 cases the visual

TABLE 2
Visual Results

Vision	Number of Cases	
	Preoperative	Postoperative
HM ½–6′	14	
CF 3–8′	13	
CF 1–3′	19	
20/400	7	3
20/300	3	
20/200	5	15
20/100	4	4
20/80	1	
20/70	1	3
20/60		4
20/50	3	11
20/40	2	8
20/30	4	10
20/25	2	4
20/20	8	22

acuity was found to be maximal after sufficient time had elapsed to allow for vitreous clearing. In no cases did improvement of vision continue over several months as has been noted by Kronfeld[6] and Sallman.[7]

Over a postoperative period varying between 2½ months and one year, five patients were found to have lost vision over that originally regained. In one, a definite macular cyst could be seen. In the others no definite ophthalmoscopic explanation was found, although the macula had been detached prior to surgery. The visual loss was as follows: 20/20 to 20/30, 20/30 to 20/70, 20/60 to 20/200, 20/50 to 20/100. Reese[8] in his detailed study showed that cystic degeneration occurred first in the macula, attaining its largest size in this area. He attributed this change to altered arterial circulation resulting in stasis of fluids. He also concluded that defective central vision suggests that macular detachment and cystic formation have existed even though not seen clinically. This late visual loss in the above cases may be the result of degenerative changes from circulatory impairment.

In the cases where the macula was not definitely detached, 21 obtained an acuity better than 20/30, one had 20/40, and two had 20/50.

Macular detachments

An attempt was made to study the return of function in those cases where the macula was included in the area of detachment. In 53 percent a total macular detachment existed, being based only on definite ophthalmoscopic findings. Questionable cases, as well as those in which the macular area was invisible due to an overhanging bulla, were not included.

The duration of the detachment was again only estimated according to the time of onset of symptoms. This was, however, believed to be frequently inaccurate as it was perhaps the time that central vision was affected rather than the onset of the original detachment. Kronfeld,[6] in 1933, after a meticulous study of his six cases and those reported in the literature, concluded that in complete macular detachment of not over eight weeks' duration, fair acuity could be expected (0.3 to 0.1), and if over two months functional recovery was rare but did occur. Gradle,[9] in 1943, felt the resulting central acuity was determined by the duration of the detachment and the patient's age, concluding that in cases of macular detachment the chance of functional return was good if the patient was not over 35 to 40 years. Subsequent to this age, he found a high percentage of macular cystic degeneration; and under 25 years, he believes that there is apt to be no degeneration despite the duration of the detachment.

Our 53 percent of macular detachments has been recorded in Table 3 as to the duration of the detachment and the age of the patient related to final acuity. (In Table 4 each case has been tabulated separately.)

TABLE 3

Macular detachments

Final Vision	Number of Cases	Age	Average Age	Duration of Detachment	Average Duration
20/20	5	14–66	44.4	7 days – 2 months	0.83 month
20/30	6	30–69	51.3	5 days – 1.5 months	0.69 month
20/40	7	42–69	60.0	3.5 weeks – 4 months	1.85 months
20/50	3	54–70	61.4	3 days – 2.5 months	1.60 months
20/60	3	44–68	56.0	10 days – 5 months	1.37 months
20/70	4	46–67	59.3	10 days – 5.5 months	3.38 months
20/100	15	45–76	59.5	9 days – 1 month	1.25 months
20/200	3	16–69	47.2	3 days –11 years	29.2 months
20/400	3	19–55	35.6	1.5 months–11 months	4.8 months

From this it can be seen that the return of good central vision is more closely related to the duration of the detachment than to the age of the patient. Although not entirely consistent, if the detachment has existed less than one month, a good visual restoration can be expected (20/30 or better), and if less than two months a fair acuity may result (20/60 or better). However, in cases of long duration one should not hesitate to attempt an operation, since useful vision for practical purposes may be achieved. The two patients with macular holes obtained 20/200 and 20/400 vision.

TABLE 4

MACULAR DETACHMENTS

Duration of Detachment	Age	Vision Before Surgery	Vision After Surgery
3 days	54	CF 4′	20/50
3 days	56	CF 6′	20/60 to 20/200
4 days	64	20/400	20/200
4 days	66	HM	20/20
5 days	54	20/300	20/30
7 days	55	CF 2½′	20/20
7 days	61	HM 2′	20/100
7 days	63	CF 1′	20/200
9 days	56	HM	20/100
10 days	30	CF 2½′	20/30
10 days	46	CF 2′	20/80
10 days	68	CF 8′	20/60
10 days	70	CF 3′	20/50
2 weeks	47	HM	20/60
2 weeks	69	CF 4′	20/30
2½ weeks	69	CF 2′	20/40
3 weeks	59	CF 8″	20/30
3 weeks	63	10/200	20/50
3 weeks	66	20/200	20/40
3 weeks	69	HM 3′	20/200
3½ weeks	42	CF 10′	20/40
1 month	24	20/100	20/20
1 month	45	CF 2′	20/50 to 20/100
1 month	61	CF 5′	20/30
1 month	65	CF 2′	20/70
1 month	66	HM	20/50
1 month	72	CF 3′	20/40
1½ months	35	20/70	20/30
1½ months	55	HM 2′	20/400
2 months	33	CF 3′	20/200
2 months	61	HM 2′	20/400
2 months	62	HM	20/50
2½ months	55	20/300	20/50
3 months	60	CF 1′	20/100
3½ months	76	20/300	20/100
4 months	37	10/200	20/200
4 months	54	20/400	20/40
4 months	57	HM ½′	20/40
5 months	53	20/400	20/60
5 months	69	CF 2′	20/400
5½ months	47	20/400	20/200
5½ months	67	20/200	20/30 to 20/70
6 months	60	CF 6′	20/50
8 months	62	CF 1′	20/200
8 months	64	HM	20/200
11 months	19	HM	20/400
1½ years	16	20/400	20/200
4 years 4 mo.	24	CF 2′	20/200
8 years	23	20/600	20/200
8 years	20	?	20/200
11 years	39	20/400	20/200

UNSUCCESSFUL CASES

In reviewing the 14 unsuccessful cases, the age of the patient varied between 1½ to 83 years, with three in the 55 to 60 age group, and four in the 60 to 65 group. Sex played no role. There was no record of refraction in seven cases, but one was a high myope of −13.0D., and three had between −1.0D. and −2.0D. The duration of the detachment varied between 3 days and 10 months, five existing from 1 to 3 months. In two cases, no retinal tear was found, and of three reoperated cases, two had no visible tear, and one had a small secondary hole. Among these 14 cases there were four horseshoe-shaped rents (two very extensive), a very large oval tear, one round hole present between the macula and disc, and six in which multiple tears occurred. These varied from 2 to 6 in number.

Six cases had total detachments, while in three the detachment involved three fourths of the eyeball, and in the remaining five only one half of the retina was detached. Three of the detachments had stiff white folds agglutinated together by vitreous strands. Prior to surgery following bed rest with binocular bandages, the retina receded markedly in three cases, slightly in four, with no changes noted in four. In three cases, the detachment progressed despite bed rest.

The surgery on all these cases was performed in the usual manner. It was uneventful with the exception of one instance when the electrode perforated an old diathermy spot resulting in vitreous loss. Drainage was good in all cases, although in two cases, trephine openings had to be made to obtain adequate release of subretinal fluid. In seven

cases 1½ cc. of air were injected into the vitreous chamber in an attempt to approximate the retina and choroid. In two cases, scleral resections were done following unsuccessful diathermy operations without further improvement.

Postoperative complications have been included in those above.

In one case the extensive horseshoe tear was seen to be still open at one small area, but reoperation was refused by the patient. In two others the tears were not closed at all.

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PROBLEMS IN RESEARCH IN ORTHOPTICS*

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Orthoptics is a comparatively new field of science. It has not yet evolved from the "trial and error" stage which is typical of all beginnings. If orthoptics is to continue its present rapid growth and to reach maturity with universal application as well as acceptance of its principles and methods, research is imperative to improve the results of our "trials" and to eliminate the wasted time and effort that constitute the bulk of "errors." We need to be able to give specific answers to specific questions, and these answers need to be substantiated by accurate data in order to gain the respect and confidence of the ophthalmologist and of the parent whose complete coöperation with the technician is so essential for worthwhile results.

The dictionary defines research as "the effort to find new information by experiment or by thorough investigation of sources; a careful inquiry or diligent investigation to discover facts by study." The key words in these definitions are: *new information, facts*—these are our immediate goal; *experiment, investigation of sources, inquiry, study*—these are the methods.

Information and facts

If one applies this definition to orthoptics and considers what new information and facts would make the daily routine of treatment more effective, he realizes that the field for research is wide and its possibilities manifold. One does not have to search for a suitable topic for study, for every day some problem arises for which there is no satisfactory solution to be found in current orthoptic literature.

Motivation for research is not a basic problem. One does not have to be inspired with lofty ideals of service or with a consuming ambition for fame and recognition. The common sense that inspired the adage, "build a better mouse-trap," is sufficient. The answer to our daily problem makes our task easier and more pleasant and helps us to avoid the tedium of purely mechanical repetition.

You may say, "But I have had no training, no experience in research methods. Where shall I begin?"

Begin thinking about that daily problem. Method will evolve from trial and error, if necessary, and "know-how" will come with momentum.

Collecting of source material

The first step in any research problem is the collecting of source material. One usually thinks of source material as all printed matter pertaining to his subject. Extensive reading is required and is greatly facilitated if one is acquainted with available library resources. Find out how you may obtain library privileges, inquire into procedures for using or borrowing books, learn the arrangement of periodicals, general reference books, dictionaries, and textbooks so that it is a quick and easy matter to find any specific reference. Some cities have a Union Catalogue Service which one may call to find out in which library any book is obtainable.

Since most articles on orthoptics and many on strabismus have been written in recent years and published in current periodicals, they can easily be found by consulting the *Index Medicus*, a reference book published twice yearly which lists all articles published in medical journals during the six months' period. The articles are listed both by author and by subject. Subheadings give the full title. There are often cross refer-

* From the Orthoptic Clinic, St. Vincent's Hospital, Erie, Pennsylvania. Read before the sixth annual meeting of the American Association of Orthoptic Technicians, Chicago, Illinois, October 12, 1947.

ences to a specific topic which might be listed under two general subject headings. Unfortunately, there is no such listing for books. One usually can obtain all important references by consulting the bibliography given at the end of articles published in periodicals. Textbooks often give excellent bibliographies at the ends of chapters on the specific material in that chapter. It is advisable to start with the latest publications and work back, as older articles may be made obsolete by more recent discoveries and study.

Studying periodicals

It is an excellent idea to keep up one's background reading as articles are published. Certainly the *American Journal of Ophthalmology* and the *Archives of Ophthalmology* are available to all of us. The *British Journal of Ophthalmology* has excellent articles. If one abstracts an article as he reads it, he has a permanent record of its usefulness available at any time. The length of the abstract and the amount of information in it may vary according to the value of the article for one's particular needs. It may be only a notation, such as good bibliography, or it may be a fairly complete summary of the entire paper. Frequently it may consist of the conclusions drawn at the end of the article. It is sometimes valuable to note for future reading references given to some other Journal not immediately available. I formed the habit of filing abstracts on white cards by general subject, such as diagnosis, treatment, statistics, tests, and so forth with author, title, periodical at the top of the card, so that they are immediately accessible. The abstracts compiled in the past two years by the American Association of Orthoptic Technicians are complete and most helpful.

Analysis of cases

Our second consideration is analysis of cases. This forms the bulk of orthoptic research. The patient is our first-hand material, and the study of his condition, reactions, and progress constitutes our original contribution in the field of research.

In everyday planning for clinic efficiency, preparation for case analysis can be started. Infinite time will be saved if records of diagnosis and daily treatment are complete, uniform, and well arranged. To illustrate, measurements by various methods should be in one space where they are easily compared. Tests for correspondence should be listed together. Printed forms which can be filled in save time and are clearer. A definite system of follow-up for discharged patients is valuable for comparative data.

Another time-saving device is a diagnostic file. When the diagnosis of each case is complete, that record should be classified under headings of possible investigation; for instance, causal factor, correspondence, amblyopia, phorias, hyperphoria, and so forth. There is no regulation set of headings. Individual interest and needs dictate one's grouping. When one wants to make a study of any of these topics, he has at hand a list of all pertinent cases and is not faced by the laborious task of going over all his records. Such a file is of value also in quick compilation of data for reports.

Perhaps procedures in case analysis will be clearer if we take a hypothetical research project and trace our steps one by one. Let us take retinal correspondence to see what is its relationship to other factors present in convergent squint, and whether type of correspondence is conditioned by any one of these factors to the exclusion of the others. The following series of topics is complete for our purpose:

1. Causal factor
2. Angle of deviation
3. Age of onset
4. Years of duration
5. Amblyopia
6. Alternation

One finds in reviewing current literature that the last four topics have been consid-

ered by various authors to be determining factors in the type of correspondence found in any case.

Selection of cases for study. The first step is selection of cases for the study. Data on every case included must be standardized and complete. Standard data in the series above would involve: (1) The same test or tests for diagnosis of correspondence, (2) definite specifications for classification into any causal category, (3) uniform method of measuring the deviation, (4) reliability of history in age of onset and duration, (5) standard system of classifying degree of amblyopia, (6) specifications for differentiation between monoculars and alternators. Any history which does not have all the above information must be discarded. Ideally, in a study of this sort, all cases of convergent squint which come into the office or clinic should be usable to give a true overall picture and the most accurate results possible. One cannot attain such uniformity, but he should attempt to keep the cases he selects representative of the whole group.

Charting of cases is the second step. A chart on which all necessary material can be listed makes it possible to collect all data on one work sheet. Large sheets of cardboard or even a roll of white wrapping paper may suffice. A usable chart for our sample project might have the following headings (adequately spaced and reading from left to right): History number, correspondence (subdivided into two columns for normal and anomalous), causal factor, angle of deviation, age of onset, years of duration, amblyopia, alternation (with three columns for monoculars, borderline cases, and alternators).

Once this information is transferred from the case histories to the chart, we are ready to get percentages.

First comes number of cases of normal and of anomalous correspondence and the percentage of their occurrence. Next, the number of cases according to cause and the percentage of their distribution. Then comes correlation of causal factor and correspondence which shows the number of normal and of anomalous correspondence cases in each causal factor category. Two sets of percentages can now be obtained: (1) For distribution of each type of correspondence through the various causal groups; that is, what percentage of cases with anomalous and what

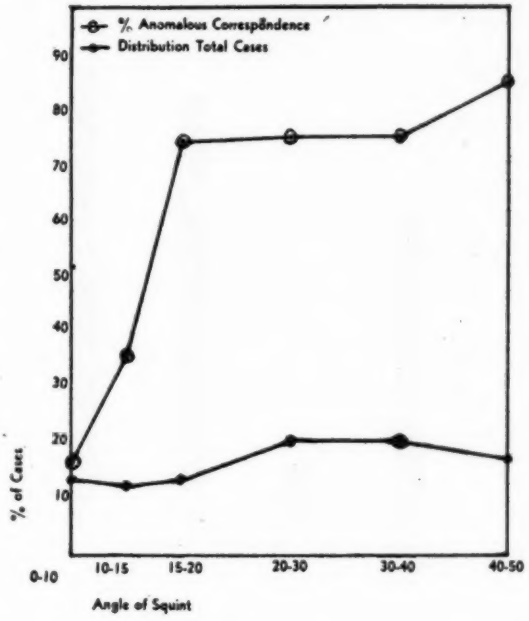

Fig. 1 (Jackson). In a graph, percentage of total cases will be the vertical component; the comparison factor, the lateral. A connected line or curve, or solid blocks may be used to show their changing relationship. A second curve or set of blocks may be used to show the incidence of anomalous or normal correspondence. When two lines or sets of blocks are used, they must have individual markings recorded in the graph key. The line or curve graph is used where the steps of the lateral factor are interrelated or show continuity. The block graph is clearer if the lateral factor is comprised of separate entities in order to emphasize comparison between them. To illustrate, a line graph works out very nicely in charting distribution of total cases and/or percentage of anomalous correspondence by angle of squint, since there is continuity in gradation of squint angle.

percentage of those with normal correspondence are accommodative, paralytic, and so forth, and (2) comparative percentages of the occurrence of both types of correspondence in each causal group, or what

percentage of cases of each of these groups have anomalous and what percentage have normal correspondence.

Our next column, angle of deviation, gives us figures on the size of the squint in our cases, and again, correlation with correspondence shows distribution of normal

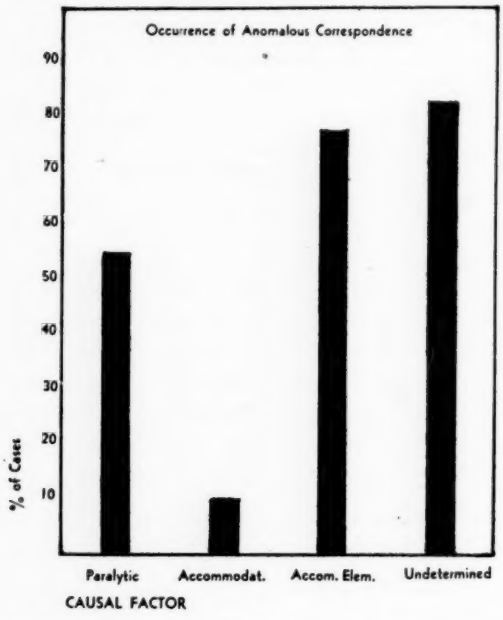

Fig. 2 (Jackson). A block graph shows distribution of total cases or percentage of anomalous correspondence according to causal factor more clearly since the entities listed are different, and we want to compare rather than to connect them.

and anomalous in varying amounts of deviation. Similarly with the other headings on our chart.

As figures are obtained for each column, they should be set down in percentage tables with headings across the page showing total cases and their distribution according to correspondence (table 1), the first column from top to bottom showing the related factor (angle of squint, age of onset, and so forth). It is a good idea to draw a graph of these figures in order to show their relationship more clearly (fig. 1).

We now have statistics on each entity and its relation to correspondence, but in order to evaluate these figures properly and to eliminate, if possible, 5 of the 6 factors, we must have relationships between the factors (disregarding correspondence for the time-being); that is, angle of deviation and causal factor, angle of deviation and alternation, causal factor and alternation and so forth.

Correlation of facts

The material is now analyzed, and the next step is synthesis or correlation of the facts so far obtained. These isolated figures are like pieces of a jig-saw puzzle which must be put together to form a meaningful picture.

Conclusions must be based on careful evaluation, comparison, checking and rechecking to make certain that no item which might alter the results has been overlooked. If statistics are accurate, certain facts become apparent, and definite conclusions can be drawn.

The principal value of a statistical survey

TABLE 1

Cases and their distribution according to correspondence*

Angle	Correspondence				Total Cases	
	Normal		Anomalous			
	No.	%	No.	%	No.	%
0–10°	20	83	4	17	24	14
10–15°	12	63	7	37	19	12
15–20°	6	25	18	75	24	14
20–30°	8	24	26	76	34	21
30–40°	8	24	25	76	33	20
40–50°	4	14	25	86	29	18

* Figures for percentage table and graphs taken from a study of 175 cases of convergent squint by Adler and Jackson: *Correlations Between the Sensory and Motor Disturbances in Convergent Squint.* Arch. Ophth., **38**: 289 (Sept.) 1947.

of this sort is elimination of extraneous factors. By clarifying the basic problem, it leads the way to further study without waste of time or effort.

The worth of any large study lies in the elimination of variables. There are always three variables in orthoptics—the child, the

methods and tools, and the technician. By standardizing diagnostic or treatment methods in the cases reported, we have eliminated one variable. We can never totally eliminate the individual factor in the other two variables. However, the more cases studied, the more are the individual differences of the child minimized. If coöperative comparative analysis could be made at various clinics, and the results pooled and evaluated as a whole, the technician variable would be reduced.

Comparison study

Another type of research project of great value in the field of orthoptics is the comparison study. Evaluation of treatment method and results would come under this heading. By comparison, one method will prove itself best, and other less efficient treatments can be discarded. In a study of this sort, it is essential to have a control group, that is, a series of cases to which cases under analysis can be compared. For instance, in evaluation of results of orthoptic treatment, we should have a group of patients who have had no treatment to give us a basis for claiming the value of orthoptic procedure. Here again, the larger the series of cases studied, the less will individual variation in cases affect the final figures.

Report of individual cases, or small series, is another method of research. Its aim and value lie in pointing out some particular phenomenon or in suggesting some form of therapy, in calling attention to some important factor not stressed by previous authors. As a classic example, I refer you to Dr. Kenneth Swan's article on "Esotropia Following Occlusion" (Arch. Ophth., **37**: 444 (April) 1947). It has aroused great interest and stimulated better therapeutics generally, besides pointing out the one factor which is basic in a condition sufficiently unusual to be puzzling when it occurs.

Writing reports

A few practical suggestions for the actual writing of papers and reports may be useful.

1. Standards of analysis must be given, so that the reader has some measure by which to evaluate the findings reported.

2. Any quotation or information from another source which you may use must be acknowledged, and the author, book or article title, periodical or publisher given in a footnote reference. Medical publications have a standard method of footnote reference which you can check on in the *American Journal of Ophthalmology* or the *Archives of Ophthalmology*. If your paper consists largely in compilation and reorganization of reading material, a complete bibliography of material referred to should be given at the end of the paper.

3. Only pertinent information must be included. Extraneous material, although interesting, detracts from the point in question. Choose a title to fit the purpose of the paper. Study your findings, and once having decided what you are trying to prove, outline the steps by which your material will build up to the final conclusion logically. Relate the introduction to the conclusions.

4. Evaluate your reader's background for the information you have to offer. You will have done extensive reading in your subject. Has this material been easily accessible to your anticipated readers? What do textbooks give on your subject? They are a good key to your reader's mind-set. Does textbook terminology coincide with yours, or will you have to simplify and explain the terms used. Consider how much background material will be necessary for your reader's understanding. It is a safe rule to err on the side of simplicity.

Topics for consideration

The problems of research are synonymous with the problems of orthoptics. The solving of individual problems carries with it a solution to basic but less specific inadequacies of the profession.

To offer a few topics for consideration:

1. There is a great need for clarification of orthoptic terms on the basis of ophthalmic terminology. Many ophthalmologists think of sensory phenomena in the terms of Worth. Since his time, the major amblyoscope has provided an entirely different group of findings. The use of Worth's terminology as applied to present-day orthoptic methods has resulted in a state of confusion which makes coöperation with the ophthalmologist difficult for lack of common understanding.

2. Comparative evaluation of method. A statistical survey of results would not only improve results but would give much needed standards for their evaluation.

3. A study of the basic principles of child psychology as they apply to orthoptics would give knowledge of what can be expected of the child at various age levels and of how to motivate the tasks which are set for him, thus helping to eliminate age and coöperation variables.

4. The collection and analysis of sensory data is needed to stimulate and direct further ophthalmological study into etiology, manifestations, and over-all treatment of squint. Further analysis of retinal correspondence and divergent squint come to mind as examples.

One of the outstanding values to be gained from research is a truer perspective of the whole field of binocular training. Faced by the constant variability of our daily cases, we are too prone "not to see the woods for the trees."

Summary

Much time and preliminary effort involved in research can be minimized by (1) a definite system in keeping records of diagnosis, treatment, and follow-up cases, (2) abstract file of current publications, (3) diagnostic file of case histories.

Analysis of cases represents the bulk of orthoptic research. Results of such analysis can be presented in three ways: statistical survey, comparison study, and report of individual cases.

Five benefits are to be derived from research in orthoptics.

1. Clarification of orthoptic terminology
2. Standardization for evaluation of results
3. Elimination of variable factors
4. Collection of sensory data
5. A better sense of perspective for routine treatment

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AGNOSTIC ALEXIA WITHOUT AGRAPHIA FOLLOWING TRAUMA*

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Agnostic alexia is an infrequent form of aphasia and is a variety of visual agnosia (mind blindness).[1] It is a disturbance of language function consisting of failure of recognition of the conventional meaning of graphic symbols, and may include inability to read letters, syllables, words, musical notes, and mathematical figures.

The terms alexia and word blindness, which are most frequently used for this condition, are somewhat objectionable in that inability to read may depend on many different focal cerebral defects. Agnostic alexia is more specific for it is used in contradistinction to aphasic alexia and semantic alexia.[2] In aphasic alexia there is loss of ability to comprehend statements of a simple character, the words being properly recognized. In semantic alexia the patient is unable to comprehend complicated statements while retaining the ability to grasp simple ones.

The act of seeing is a highly complicated procedure requiring the integrity of the optic apparatus and a considerable part of the cerebral cortex. Much of the mechanism of how it is accomplished is conjectural and controversial, and its study involves the fields of anatomy, physiology, and psychology.

Experimental and clinical investigations have proved that the calcarine area (area 17 of Brodmann) of the occipital lobe is the site of the primary cortical termination of the visual impulse.[3] Neurons from the retina maintain a precise spatial organization in their course to the external geniculate body and thence to the calcarine cortex, thereby producing point to point retinal representation throughout the radiation and calcarine area.[4, 5] Decussation of the nasal half of the optic-nerve fibers results in cortical representation of the nasal half of the contralateral retina and of the temporal half of the homolateral retina.

The question of the physiologic relationships concerned with the higher visual areas is far from settled. Many ingenious schemata of brain localizations have been worked out, based partly on experimental and clinical data and partly on psychologic premises. This has led one school of thought to accept more or less rigid conceptions of various centers and tracts. On the other hand, many neurologists believe that our knowledge of the various sensory centers and association tracts is not yet sufficiently accurate to warrant such concepts of localization.[6-13]

It is quite generally agreed that the occipital lobe is primarily concerned with vision, and that area 18 of Brodmann which surrounds area 17 (the calcarine cortex), and area 19 which surrounds area 18 are concerned with visual association and organization[6] (fig. 1). There is less agreement regarding other salient features. Definite proof of the specific functions of areas 18 and 19 is lacking. Area 18, receiving impulses from area 17 only, is believed to be the center for recognition of objects and probably of colors.[2, 14] Area 19, which receives impulses from all parts of the cortex, serves as a center for coördinating visual and other reflexes.[6] Its chief function seems to be that of revisualization.[15] Area 37 and the region immediately anterior to it is believed by many neurologists to form a field in which language is formulated.[2]

Ferrier,[16] in 1875, concluded that the area of cortex chiefly concerned with recognition of written or printed words was the dominant angular gyrus (area 39). This opinion

* Presented at the 83rd annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1947. From the Department of Ophthalmology, Syracuse University College of Medicine.

was not generally accepted for a long time and is not universally accepted even now. However, most neurologists, due to the investigations of Dejerine, Henschen, Pötzl, Hinshelwood, Nielsen, and others, maintain that the angular gyrus and the area immediately beneath it are essential for the visual recognition of letters, words, and musical notes. The center for mathematical figures is believed to be closely adjacent in the parieto-occipital region, and according to

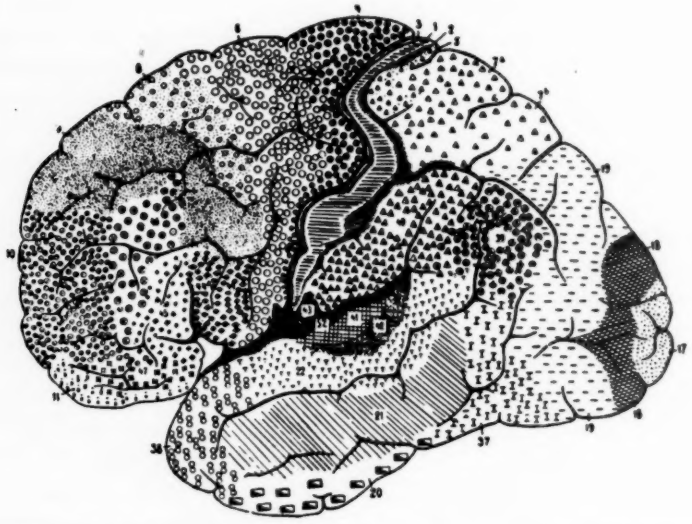

Fig. 1 (Joy). Brodmann's architectonic chart of the cerebral cortex. Lateral aspect. A large part of area 4 actually lies within the fissure of Rolando and areas 41, 42, 43, and 52 lie within the fissure of Sylvius. (From: Ford, F. R.: *Diseases of the Nervous System in Infancy, Childhood, and Adolescence.*)

Henschen[17] is situated about the borders of the interparietal sulcus.

The angular gyrus apparently has two functions, one for recognition and the other for the revisualization of the written or printed word symbol.[2] In this cortical zone the optic images of words are thought to become integrated with the corresponding representatives of the other sense organs, and only when such integration takes place does a word take significance.[18]

Symbols are in the sphere of language and unilateral dominance is much more pronounced in all language functions than in recognition of objects in general; thus, the major or dominant angular gyrus is essential to reading function.[7] The minor angular gyrus in most instances has its engrams so crudely made that it functions poorly unless forced to do so by lesions on the dominant side.[19] Even then, except in the very young, it usually takes years to function well.

The various subdivisions of the higher cortical visual field have more or less intimate association with each other in accordance with the degree of association between their functions. The angular gyri of the two hemispheres seem to be connected with each other, with the primary cortical areas of vision in both hemispheres, with the optic thalamus, and with other special sense centers, including Wernicke's auditory-word center and Broca's motor-speech center.[20] It apparently has numerous associating tracts with other centers contributary or coördinate in function, like those for object seeing and for stereognostic function.[21] It is also believed to be connected with the language formulation area whose chief function is the association of names with objects, concepts of which are obtained from the special senses.[21]

The functional relationship of the angular gyrus to Wernicke's center in most individuals and to Broca's center in some individuals is particularly close. In childhood word impressions are first received through the auditory mechanism, and the word is thus interpreted as it is heard. In most instances this habit continues throughout life. However, so-called sight readers, who are strongly visually minded, learn in time to read without reliving the sound-memories of each word and acquire independence from Wernicke's center.[2]

Also in childhood, word impressions are closely associated with the motor-speech center. As the child learns to read he enunciates, and as a result the printed image of the word becomes intimately tied up with the sound of the word. If his training in reading doesn't advance beyond the point of enunciating, this close association persists throughout life. However, most educated individuals develop silent reading ability and ultimate independence from Broca's center.[2]

Thus, the perfect functioning of the visual word center presupposes the integrity of the center, of all of its association tracts and of the other special sense areas.

Agnostic alexia

The most frequent type of agnostic alexia is blindness for letters and words.[21] Although letter blindness may appear without word blindness and word blindness without letter blindness, the two are usually associated and are almost always accompanied by inability to read musical notes, and much less frequently by blindness for mathematical figures.[2] The degree of alexia may vary considerably; some patients are able to recognize one or two or several symbols, while others exhibit complete loss of identification.[21]

Several bizarre types of alexia have been recorded; for example, in bilingual individuals there may be blindness for one language while ability to read another with similar characters is retained.[22] It has been assumed that such cases indicate that the engrams of different languages are laid down in separate areas.[21,22] However, the more modern conception is that such cases represent incomplete alexia. It is believed that in the disorganization that takes place in alexia the more complex and more recently acquired language functions are lost first.[2, 18] Thus, a foreign language is lost before the native language, and words are lost before letters. This order also holds true in the return of function in favorable cases, the more simple and basic functions returning first.

The faculty of reading is not only confined to letters and words but also applies to mathematical figures. The relatively infrequent occurrence of numeral alexia has received much comment in the literature. In the classic picture of pure alexia described by Dejerine,[23] and in a great many cases recorded since, the reading of figures and the ability to calculate were entirely conserved. This frequent sparing of mathematical figure language in agnostic alexia has led to the assumption that numbers and calculations are functions independent of letter and word language, and that they have their own cortical center and connecting pathways, which, although independent of each other, lie in the same vicinity.[2, 17, 21, 23, 24]

On the other hand, many neurologists consider it unlikely that the various symptoms of optic agnosia have a separate localizing significance. A. Adler[9] expressed the belief that agnostic patients recognize numbers more easily than letters because there are only 10 numbers and it is comparatively easy to recognize them by a few characteristics.

Agnostic alexia in itself is not pathognomonic of a lesion in a certain cerebral area, for language is a very intricate function requiring for its use the entire brain.[1] A lesion in any one area may so affect the mechanism as to interfere with activities other than those mediated directly by the involved area.[25] Moreover, when language function is disturbed mental functions may

also be affected and they, in turn, influence the language disturbance.[18] Therefore, to determine the site of the lesion producing alexia other factors must be taken into consideration.

Because of the fact that agnostic alexia is a disturbance of language function the lesion producing it is almost always in the dominant or major hemisphere (left in right-handed individuals). Atypical cases in which necropsy has revealed a right-sided lesion in right-handed individuals have been explained on the basis of unrecognized left-handedness, an unrecognized lesion of the left cerebrum, or ipsilateral cerebral dominance.[2] Chesher has shown that in about 6 percent of persons the major hemisphere in language is ipsilateral to the major hand.[1]

All lesions within the secondary visual area produce impairment of visual memory.[20] These disabilities represent the loss of previously acquired engrams of memory and concepts in which visual memory was a component. Cortical lesions which destroy engrams of visual memory cause a loss of both recognition and revisualization, but subcortical lesions which interrupt connections between these areas and the calcarine fissure of both occipital lobes cause only loss of recognition.[23]

On this premise destruction of the dominant angular gyrus destroys both recognition and revisualization of letters and words resulting in inability to either read or write: cortical agnostic alexia. On the other hand, if the association tracts connecting the angular gyrus with both calcarine areas are interrupted, only recognition is lost. The individual, although unable to read, can write to dictation and usually spontaneously, for revisualization is not affected. However, as recognition is lost, he is unable to read what he himself has written. This condition, the pure word blindness of Dejerine, is produced by a subcortical lesion in the dominant occipital lobe, which, due to its anatomic location, almost always impinges upon the optic radiation.[24] As a rule the affected fibers are destroyed, resulting in a permanent congruous contralateral homonymous field defect. In most cases there is complete hemianopia, but if only part of the fibers are affected a quadrantic defect may occur.[28–31]

Quadrant defects are produced by lesions affecting the upper or lower contralateral quadrantic fibers of the optic radiation or the upper or lower lip of the calcarine fissure. The field defect is usually bounded by vertical and horizontal radii in lesions of the radiation, and the temporal lobe is more frequently affected than is the occipital lobe.[32] Holmes[5] explains the reason for the contour of the field in quadrantanopia by assuming that the fibers corresponding to the upper and lower quadrants may be separated by an anatomic interval, an opinion that has also been expressed by other authors.

Inferior-quadrant defects occur much more frequently than do superior defects, except in lesions of the temporal lobe. In these cases the resultant field defects are characterized by their incongruity and their tendency to be right angled. On the other hand, occipital lobe lesions produce defects which are always congruous with angles of variable degree.[32]

In cortical lesions there is no anatomic reason why a quadrant defect should have a clean-cut horizontal boundary. Consequently, homonymous quadrantanopias with irregular outlines and steep edges are characteristic of affections of the calcarine fissure.[32]

All cases of agnostic alexia are not caused by cortical or subcortical lesions of the angular gyrus. Due to the close relation between the auditory function and reading in most individuals, and between motor-speech and reading in some, agnostic alexia may also occur in such patients in lesions of Wernicke's center or Broca's convolution, or in the connecting tracts.[33] Thus, in a given case one cannot tell by alexia alone where the lesion is.

The presence of pure word blindness without other aphasic symptoms or general cerebral disturbances is quite uncommon, for

anatomically it presupposes a highly restricted nonexpanding lesion.[26, 27] Such a lesion would have to miss the numerous other association tracts in the occipital lobe and the adjacent visual language areas. Moreover, the picture of any particular aphasia may change, depending on the nature of the lesion producing it, on cerebral substitution, and on reëducation.[18]

The relation between visual verbal alexia and numerical alexia has already been discussed. The presence of the latter, which is usually accompanied by impairment in calculation, may be explained on the same basis as that of verbal alexia; namely, interruption of the association tracts connecting the calcarine areas with the numeral center.[2] However, it is possible that the retention of ability to read numbers in cases of word blindness represents incomplete alexia.[9]

In the presence of subcortical lesions of the angular gyrus, agnosia may occur not only for symbols, but for objects (amnesic aphasia) and colors (color amnesia).[25, 34] In these disabilities, which are in the zone of language the patient may be unable to call an animate or inanimate object or a color by name even though he recognizes and comprehends it. Amnesic aphasia alone is of little localizing value, for it has been described in lesions of the frontal, parietal, and temporal lobes; in cases with no demonstrable pathology; and in toxic states, dementia, senile involution, and other conditions. It most commonly results from lesions in the language formulation area (area 37) or the temporal isthmus.[2] Due to the close proximity of the isthmus to the angular gyrus, Nielsen[2] expressed the belief that lesions in this locality which cause amnesic aphasia are responsible for angular and adjacent parietal lobe defects. Color amnesia is thought to be due to an occipital lesion affecting area 18.[2]

Westphal,[21] over 75 years ago, recorded the first case of alexia without agraphia. However, Dejerine,[23] in 1892, gave the first complete and detailed physiologic and anatomic description of the differentiation of the subcortical from the cortical type. Within the next few years Dejerine's and Serièux's interpretation was confirmed by Bastian, Broadbent, Hinshelwood, and others.[24, 27]

Although ophthalmic literature has shown little evidence that such a condition existed, cases of subcortical agnostic alexia have appeared in the neurologic literature during the past 50 odd years with sufficient frequency to indicate that the condition is not particularly uncommon. However, this is not true of those cases following cranial trauma, for they are very rare.[30]

Although basically a neurologic problem, some of its most important features embrace the field of the ophthalmologist who, on occasion, may be the first physician consulted by the patient. Therefore, it is important that he be familiar with all of its aspects.

It is for this reason, as well as for the infrequent occurrence of the condition following trauma, that this case is reported.

Case report

History

Mr. C. S., a locomotive engineer, aged 62 years, was seen for the first time on October 1, 1946, 10 days after an apparently slight head injury.

On the evening of September 21st, while returning home from work as a passenger in the front seat of an automobile, he struck his head against the sun visor in a minor collision. Immediately after the accident he got out of the car by himself and stood upon his feet without any apparent difficulty. However, he appeared quite dazed, did not recognize people and complained of foggy vision. Full consciousness of his surroundings did not return until his arrival at St. Joseph's Hospital about one hour later. Examination at that institution revealed no evidence of injury except a deep laceration of the skin of the right forehead. Immediately after the wound was sutured, the patient returned home and was placed under

the care of his private physician, Dr. F. I. Bishop. Aside from some mental confusion, he felt no ill effects from the injury and noted nothing unusual until the following morning, when upon picking up the newspaper, he discovered to his astonishment that he was unable to read.

Physical examination

Dr. Bishop examined the patient on September 22nd. His report follows: A rugged muscular male with no apparent defect except a 7-cm. transverse irregular sutured wound across the right forehead. No evidence of vascular disease: blood pressure 134/78 mm. Hg; pulse ranges from 70 to 80. Urine negative. Wassermann reaction negative. No paralysis or anesthesia excepting for numbness about the wound. No headache or vomiting since accident. He denies serious illnesses and previous injuries. As an employee of the railroad he has been examined periodically at two-year intervals for many years. His general physical condition is unchanged since the last previous examination less than one year ago.

Ophthalmological examination

The patient was still unable to read 10 days after the accident and was referred for ophthalmic consultation, a procedure which extended over a period of three successive days. As he entered the office, his gait appeared normal and he exhibited no difficulty in following directions as to where he was to sit. In taking his history he proved intelligent, coöperative, and mentally alert. He seemed to understand all that was said to him, and spoke fluently and without hesitation. He did not appear apprehensive or depressed and was not unduly alarmed. His only complaint was inability to read, and he was confident that new glasses were all that he needed. There was no apparent disorientation of any kind: he had had no difficulty in finding his way about since the accident and readily distinguished right from left. He stated that he had always been right handed, as were his four children and that, so far as he knew, so were all of his forebears.

The visual test revealed that, although he could not distinguish letters, words, or numbers irrespective of size, uncorrected vision of 20/25 was obtained in either eye with the illiterate chart. Vision was correctable to 20/20 and the illiterate equivalent of J1 with glasses. Externally his eyes appeared normal. There was no derangement of the extraocular muscles, nor was nystagmus present. The pupils were equal in size and their reaction prompt. The lenses were only moderately sclerosed and the media were clear. Examination of the fundi revealed normal optic discs and very early senile sclerosis of the retinal vessels compatible with his age. The central fields were normal but the peripheral fields showed a right, homonymous, congruous, irregular upper-quadrant defect with sharply demarked edges (fig. 2).

He was able to write spontaneously and to dictation with promptness, but in no instance could he read a single letter, word, or number that he had written unless he traced the symbols with his finger. Even then, he did so in a stumbling, halting, and incomplete manner. Also, he could do none but the simplest calculations, being almost totally unable to add or subtract beyond two digits or to multiply beyond one digit. There was no evidence of geometric object agnosia; he copied squares, circles, and triangles correctly and also drew them spontaneously. As he had had no musical training, he was not tested for musical notes.

During the examination, it soon became apparent that the patient could not call by name even familiar objects although he knew what the objects were. He knew that a knife was used for cutting, a pen for writing, and a watch for telling time, but he could not call them by name, even though he handled them and listened to the watch.

He had similar difficulty in naming colors, although his color discrimination proved

normal with the Ishihara, American Optical pseudoisochromatic, and Holmgren yarn tests. While he showed no amnesia for animate objects, upon specific questioning he stated that for the first day or two following the accident he could not even call the members of his own family by name although he recognized them perfectly.

Neurologic examination

On October 4th, Mr. S. entered Syracuse University Hospital for neurologic study by Dr. Wardner D. Ayer, the chief points of whose report follow:

The patient appears well orientated and coördination is excellent, but he shows definite anomia and complains of inability to recognize the printed word. He is right handed.

Cranial nerves are negative except for the field defect. In hearing tests, his tuning-fork responses are excellent and normal in both ears. There is no nystagmus nor vertigo. Facial movements are symmetrical. No facial anesthesia is present except that about the wound. Pharynx is normal. There is good gag reflex. The patient swallows normally. The tongue is in mid line. There is no dysarthria; good enunciation; no aphonia. The neck shows no rigidity.

The extremities show normal motor, reflex, and sensory status.

Careful studies for a right hemianesthesia show none. On testing for astereognosis, he apparently recognizes the objects and claims they feel the same in the two hands but he cannot name them. No pathologic reflexes are present. Abdominal and cremasteric reflexes are active and equal. Gait and station are normal.

Lumbar puncture: 5 cc. of very slightly xanthochromic (light picric-acid hue) spinal fluid were removed under no increase in pressure; cell count, 3 white cells, few red cells (actual count not made); protein, 33 mg. Wassermann reaction was negative. X-ray studies of the skull showed no fracture or other abnormality.

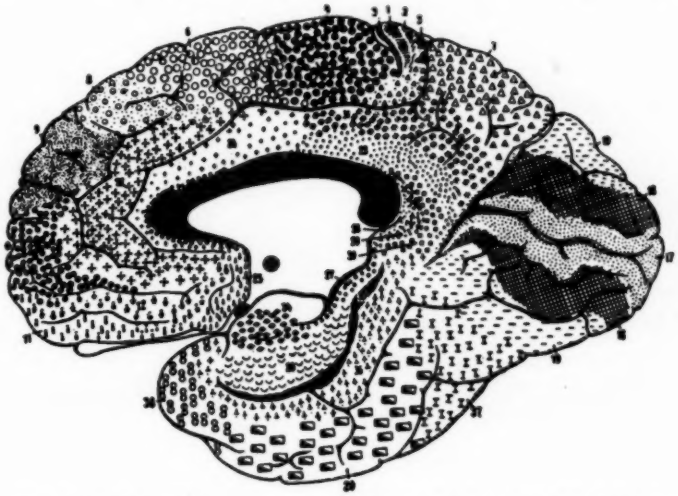

Fig. 2 (Joy). Brodmann's architectonic chart of the cerebral cortex. Mesial aspect. (From: Ford, F. R.: *Diseases of the Nervous System in Infancy, Childhood, and Adolescence.*)

For the three days in the hospital, the patient seemed very comfortable. On one observation the right pupil was larger than the left, but otherwise they were normal. His aphasia continued but seemed somewhat less marked on his discharge.

Clinical course

This patient has been under observation over a period of eight months and is now apparently as well as ever except for persistence of the field defect which has re-

mained unchanged. During the first month, all aphasic symptoms subsided appreciably and, by the end of the month, there was only occasional difficulty in naming objects and colors. Ability to identify symbols returned more slowly, but by this time he was able to read fairly well and seemed to understand the meaning of the printed text. However, he missed many multiple syllable words, became fatigued after reading a few sentences, and was consistently confused by certain letters, particularly C & G, b & d, F & E, Y & X, y & x. Numbers caused him less trouble but he had difficulty in differentiating 3 from 8, and 6 from 9. Simple addition, subtraction, and multiplication were accomplished with few mistakes.

By the end of the second month there was no evidence of amnesic aphasia or color amnesia. He was now able to read the newspapers a little, but stated that he had to give up after 2 or 3 paragraphs because of fatigue. A reading test demonstrated frequent hesitation while he spelled out the longer words and he still confused b & d.

There was gradual improvement in the next two months and by the end of the fourth month he felt that he could read as well as ever and without fatigue. He stated that he had never been good at figures but believed he could calculate now as well as before the injury. All confusion of symbols had disappeared.

On January 14, 1947, he was referred to Dr. W. M. Cruickshank of the Psychological Services Center of Syracuse University for complete psychologic investigation. An epitome of the report follows:

On the Wechsler-Bellevue Intelligence Scale the subject received a verbal I.Q. of 97, a performance I.Q. of 94, and a total I.Q. of 97. This places him in the normal group intellectually.

In the advanced progressive reading tests covering seven areas, involving vocabulary and comprehension, and including mathematics, science, and literature, results correlating favorably with the subject's educational background and intelligence level were obtained. These tests showed no concrete evidence of anomia, and there is no evidence of the presence of any form of aphasia.

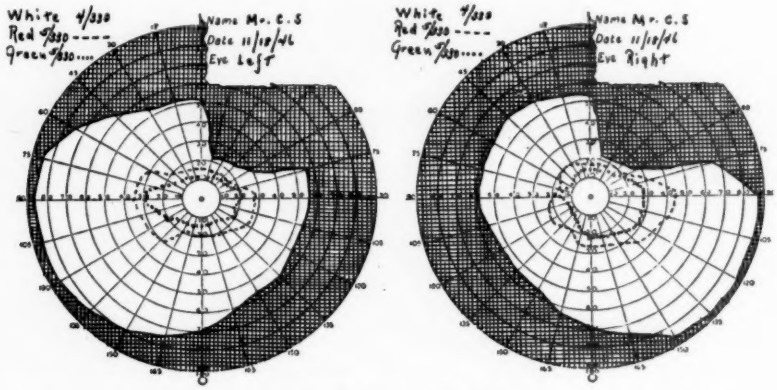

Fig. 3 (Joy). White 2/330 and 1/330 equal the same boundary in defect.

On March 17, 1947, six months after injury, Mr. S. resumed his occupation as a locomotive engineer, his employer feeling that the field defect was not a sufficient handicap to force his retirement. He has carried on to date (May 29, 1947) without incident or accident and feels as well as ever in every way. However, the field defect remains unchanged.

Discussion and Summary

In this case we are dealing with an apparently previously healthy individual who, following a seemingly minor head injury,

suddenly developed aphasic symptoms consisting of visual agnosia for symbols without agraphia, acalculia, amnesic aphasia, and color amnesia, along with right homonymous upper congruous irregular quadrantanopia. All aphasic symptoms disappeared within four months, but the field defect has persisted.

There was no paralysis or anesthesia, intelligence was not affected, and orientation was not disturbed. Motor speech was not involved and spoken words were perfectly understood.

The history of injury, the sudden onset of symptoms, the presence of blood in the spinal fluid, the limited disturbance of the lesion, and the rapid recovery without development of further symptoms all indicate a vascular lesion, probably hemorrhagic in character, with adjacent edema.

The disturbance was primarily that of language on the receptive side without involvement of the auditory or motor-speech mechanisms. Although the absence of a necropsy prevents positive proof of the site of the lesion or lesions producing the symptoms, there is sufficient clinical evidence to indicate with reasonable certainty that it was situated in the left parieto-occipital region.

The reasons for this assumption are as follows:

1. In almost all of the recorded cases of the subcortical type of agnostic alexia which have gone to autopsy the causal lesion has involved the occipital lobe, destroying the association fibers connecting the angular gyrus with both calcarine fissures.

2. Color amnesia is generally considered to be due to lesions of the occipital lobe.[2]

3. Although it is true that amnesic aphasia is usually caused by involvement of the temporal lobe, in the presence of subcortical agnostic alexia the lesion is more likely to interrupt the association fibers in the isthmus,[2] and such a lesion may be in the parietal lobe.

4. Homonymous hemianopia, or less frequently quadrantanopia in the lower field, is almost always present in subcortical agnostic alexia, due to impingement of the lesion on the optic radiation. The upper quadrant defect in this case does not necessarily conflict with the evidence at hand. The presence of congruity militates against an affection of the temporal lobe. It was probably caused by a vascular lesion involving the inferior fibers of the posterior segment of the optic radiation. Quadrant hemianopias are characteristic of vascular lesions in this region, since it is here that the upper and lower halves of the radiation are supplied by two different and separate vessels.[35] However, the field defect could have been caused by a traumatic lesion of the inferior lip of the calcarine fissure.

Franceschetti and deMorisier,[30] in discussing their case and that of L'hermitte, deMassary, and Huguenin,[29] in which there was a lower quadrantanopia, theorized that the field defect was caused by contusion of the upper lip of the calcarine fissure. In pondering why the upper lip should be more exposed to injury than the lower lip, they expressed the belief that the superior lip is more vulnerable because it is in contact with the tentorium and so is much less resistant.

Conclusion

As previously indicated, the site of the lesion or lesions in the case herein reported cannot be determined by any aphasic symptom alone or by the field defect alone. However, taking them all together and in association, the most probable site is in the parieto-occipital region of the left hemisphere. Although the presence of multiple lesions cannot be ruled out, it is tempting to speculate whether a single lesion did not cause all of the symptoms. Involvement either of the parieto-occipital branch of the middle cerebral artery, or of the calcarine branch of the posterior cerebral artery, could produce the necessary pathologic changes. It is probable that the lesion consisted of contusion, hemorrhage, and edema.

Recovery from the aphasic symptoms indicates that the cerebral trauma was not severe. In spite of the evidence of a hemorrhagic lesion, it is probable that contusion and edema played an important part, for the relatively rapid subsidence of the symptoms is definite proof that the association tracts were not irrecoverably destroyed. If an anatomic area subserving a functional unit of language is destroyed, it never recovers.[34] In such cases, return of function depends on training of the homologous area of the other hemisphere, which in a man, aged 62 years, would not occur for a long time, if ever.

The persistence of the field defect is not unusual, for the suprageniculate visual pathway appears to be more vulnerable to insult than do the association tracts.

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WIDENING OF THE ANGIOSCOTOMA IN THE ALARM REACTION*

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Introduction

The various symptoms of alarm are well known. These consist of pupillary dilatation, protrusion of the eyeballs, cutaneous vasoconstriction, contraction of the smooth muscles of the skin causing "gooseflesh," the erection of hairs in man, and increased sweating. Another effect, due to psychic influences, as noted by Evans[1] was a widening of the normal angioscotoma.

An opportunity to study alterations in the angioscotoma in three alarmed subjects was afforded, and the findings are herein reported.

Method and material

Gradle,[2] in 1916, believed that the blind areas resulting from the large vessels as they pass from the disc on to the perceiving retina were relative and could be traced several centimeters away from the disc. It is felt by Evans[1] that the angioscotoma is a defect in the visual field related in form to the pattern of distribution of the retinal vessel tree. Duke-Elder[3] defines angioscotometry as the tracing out of thin bands of physiologic blindness corresponding to the retinal blood vessels.

Technique

Various investigators have mapped out these shadows using different methods. The technique followed in this study was that of Evans.[1, 4] The Evans stereocampimeter and charts were employed and the test object which was used in all cases was 0.4 mm. in size, spherical, and white. The illumination of the test chart was 15 foot-candles, and monocular fixation was employed.

The test object was moved from the seeing to the nonseeing area, and at all times at right angles to the border of the defect. The blindspot was first outlined and then the object was moved around the periphery of the blindspot until the superior arched angioscotoma was located and plotted. When the width of these bands, adjacent to the blindspot, was greater than 1.5 degrees, they were considered to be abnormally widened. This study was limited to the changes that occurred to this band, since the time element in these particular studies did not permit the mapping of the other bands which originate from the blindspot.

Subjects

(a) Selection. Three individuals were studied while in a state of alarm, under the following circumstances, at the Long Island College Hospital.

Case A was one of a group being examined for the action of a certain drug on the angioscotoma. After the normal angioscotoma had been plotted, prior to the introduction of this drug, a nurse entered the examining room and notified the patient that a cablegram was being held for him in the superintendent's office. This subject immediately showed signs of alarm because, as he stated, his wife who lived abroad had recently become ill. It was requested that the cablegram be delivered to the examining room, and in the interim, while in the state of alarm, his angioscotoma was recharted.

Case B and *Case C* were seen simultaneously in the accident room of the hospital, markedly frightened although coherent and well oriented. They had been working on a chemical experiment at a technical school nearby, when a sudden explosion occurred,

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TABLE 1

APPEARANCE AND DURATION OF CHANGES IN SCOTOMA. (SUBJECT EXAMINED BEFORE FRIGHT; AFTER FRIGHT; AND AFTER REASSURANCE.)

	Subject A Time	Pupil	Scotoma Units
Physiologic Angioscotoma	8:45	4	42
Immediately after Saline	9:10	4	42
Immediately after Fright	9:32	7	128
Time Patient Reassured	9:33		
	9:35	6	119
	9:45	4	64
	9:53	4	42
	10:00	4	42
	10:15	4	42

shattering most of the glass equipment. Pieces of glass were found imbedded in the skin of the lower part of the face and chest in both subjects. The chief concern of these individuals was whether glass had entered their eyes. Ocular examinations were entirely negative. Without being notified of this fact, angioscotomas were plotted on these patients, while still in a state of fright, 10 to 15 minutes after the explosion had occurred.

(b) History and physical condition. All known causes for alteration of the angioscotoma were ruled out in the three subjects.

Case A, a British seaman, 24 years of age, a patient in the hospital with a diagnosis of fungus infection of the arms and chest, was otherwise in good physical condition. Past history essentially negative.

Case B, a woman school teacher, 26 years of age, in good physical condition. Last menstrual period, two weeks prior to examination.

Case C, a man, an accountant, 31 years of age, in good physical condition.

PROCEDURE

Case A had a normal angioscotoma plotted, and after the psychic disturbance, was immediately reëxamined. The news contained in the cablegram relieved his anxiety and his angioscotoma was again charted and repeated every 10 minutes until no further change was noted after three successive examinations.

The angioscotomas of *Case B* and *Case C* were plotted while they were still frightened. These patients were then reassured that no foreign body was present in their eyes and their angioscotomas were recharted every 10 minutes, until there was no further change in the width of their respective bands.

OBSERVATION

Widening of the angioscotoma was found in all these cases.

In *Case A,* the normal angioscotoma was first plotted and a control secured by instilling into the conjunctival sac several drops of saline. After being subjected to alarm, a marked widening of the angioscotoma was obtained. Immediately after fright had been dispelled the angioscotoma was found to be slightly less widened and gradually returned to normal with each successive reëxamina-

TABLE 2

APPEARANCE AND DURATION OF CHANGES IN SCOTOMA. (SUBJECTS FIRST EXAMINED WHILE IN FRIGHT AND THEN REËXAMINED AFTER REASSURANCE.)

Subject B (Frightened at 10:45) Time	Pupil	Scotoma Units
11:00	5	110
Time Patient Reassured: 11:08		
11:10	5	95
11:20	5	69
11:30	5	32
11:40	5	32
11:50	5	32

Subject C (Frightened at 10:45) Time	Pupil	Scotoma Units
10:55	5	120
11:05	5	105
Time Patient Reassured: 11:13		
11:15	5	70
11:25	4	44
11:35	4	44
11:45	4	44

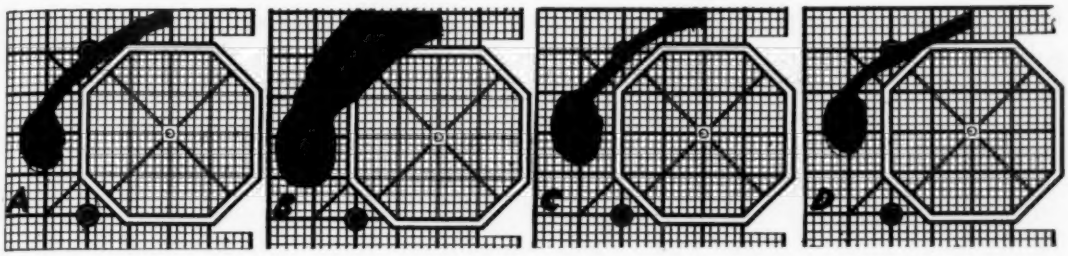

Fig. 1 (Cholst). Angioscotoma plotted to show the effects of fright on *Subject A.* (A) Normal angioscotoma. (B) Immediately after fright. (C) Twelve minutes after reassurance. (D) Twenty minutes after reassurance.

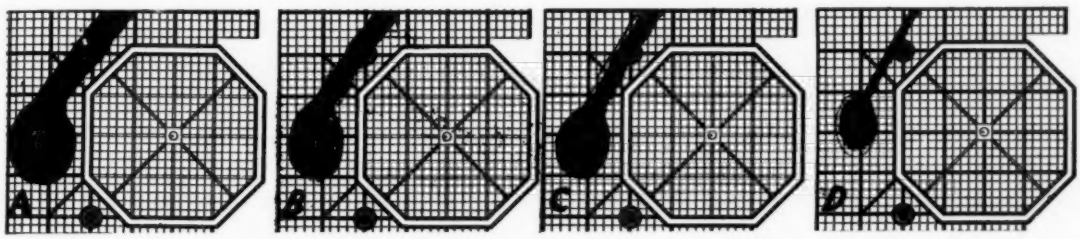

Fig. 2 (Cholst). Angioscotoma plotted to show the effects of fright on *Subject B.* (A) Fifteen minutes after fright. (B) Two minutes after reassurance. (C) Thirteen minutes after reassurance. (D) Twenty-two minutes after reassurance.

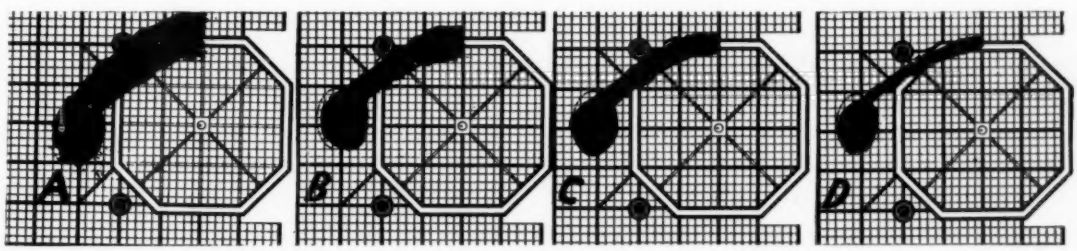

Fig. 3 (Cholst). Angioscotoma plotted to show the effects of fright on *Subject C.* (A) Ten minutes after fright. (B) Twenty minutes after fright. (C) Two minutes after reassurance. (D) Twelve minutes after reassurance.

tion. The normal angioscotoma was again plotted *20 minutes* after anxiety had been relieved.

In *Case B* and *Case C,* the subjects were in a state of fright when their respective angioscotomas were first plotted and an abnormally widened band was plotted in each case. After cause for alarm had been dispelled and the patients reassured, a progressive narrowing of the originally widened angioscotomas was obtained with each plotting. No further narrowing in Case B occurred 22 minutes after fright had been dispelled, and in Case C after 12 minutes. (When the same width occurred after three successive plottings, they were regarded as the normal bands for these individuals.)

Comment

In an attempt to explain the origin and characteristic changes of the angioscotoma, it is apparent that one cannot make the simple assumption that the areas mapped are direct projections of the Purkinje vessel shadows. Vascular dilation is probably not the explanation of the widening phenomenon because:

1. A corresponding change in the diame-

ter of the retinal vessel is not noted when studying the fundus with the ophthalmoscope. For example, when pressure is made upon the globe, the retinal vessels narrow, although the angioscotoma widens.

2. The degree of widening of the angioscotoma is often so great and so rapid that a retinal vessel would probably rupture were it dilated correspondingly (since the widening may be 5 or 6 times greater than the normal angioscotoma).

Alteration of the normal angioscotoma, according to many workers, may be influenced by numerous factors, physiologic as well as pathologic. One hypothesis has been presented[1] in an effort to explain the origin of the alteration of any angioscotoma and is known as the angiogenic hypothesis. This states that the synapse is the most easily interrupted point in the neuron chain. It is extremely sensitive to deleterious agents and in this way acts as a sort of fuse to protect the delicate rod and cone layer. Interference with the normal posterior drainage fluid from the eye, via the perineural and perivascular spaces, produces a temporary damming up of the fluid with a consequent edema of the synapse.[5] This results in a loss of response of the rod or cone of the corresponding chain and widening of the angioscotoma results.

Evidence was found in the literature which suggests a possible explanation for the alterations of the angioscotoma in this study.

Cannon,[6] in his classic experiments with the denervated heart, proved that fright, rage, pain, among other things, produced a reflex liberation of an adrenalinlike substance causing an acceleration in the heart rate of about 20 to 40 beats per minute. Removal of the adrenals or their denervation prevented this effect.

According to Burton-Opitz,[7] working with animals, injection of epinephrine into the circulation produced a rise in venous as well as arterial pressure. G. Rosenow[8] also observed this rise in venous pressure in normal men, using hypodermic injections of epinephrine. Clinically, dilation of the veins of the forehead and neck in individuals under psychic tension has been noted. Changes in venous pressures are accompanied by similar changes in the cerebrospinal fluid pressure, state Merritt and Fremont-Smith.[9]

They found that patients who have increased venous pressure, such as accompanies congestive heart failure, frequently show increased cerebrospinal-fluid pressures. In 32 patients with congestive heart failure the cerebrospinal-fluid pressure was found to be elevated. In studying the effect of the administration of drugs on the cerebrospinal-fluid pressure, they noted that adrenalin produces an increase in cerebrospinal-fluid pressure.

Evans believes that increased intracranial pressure produces a mechanical dilatation of the perivascular spaces by obstructing the posterior drainage system of the intraocular-tissue fluid. It is interesting to note that Spaeth[10] reported a patient with an intracranial vascular lesion who had early extensive widening of the angioscotoma.

There is thus ample evidence that an adrenalinlike substance is liberated in psychic disturbances. The explanation for the widening of the angioscotoma in fright could possibly be due to a transient increase in venous blood pressure which, in turn, produces an increased intracranial pressure. This interferes with the normal drainage of the intraocular-tissue fluids posteriorly, causing a dilatation of the perivascular spaces. The back pressure that ensues interrupts the synapse in the underlying retina due to the edema produced, resulting in a widening of the angioscotoma. Thus, the widening of the angioscotoma in acute apprehension could be explained by the angiogenic hypothesis.

The disappearance of the psychic stimulus is followed by a reversal to normal physiology, which can be clinically noted by the normal angioscotoma replotted.

Conclusion

1. This study presented the effect of alarm on the angioscotoma and also the possible physiologic mechanism involved.

2. A widening of the angioscotoma was demonstrated in the three cases studied, which gradually returned to normal shortly after the causes were removed.

3. This effect of fright could perhaps be a source of error in the mapping of the blindspot when routine central scotometry is performed on individuals in an apprehensive state.

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THE CHARACTER OF THE NYSTAGMUS INDUCED BY AMYTAL IN CHRONIC ALCOHOLICS*

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Barbiturate drugs are known to influence ocular movements in man and in the experimental animal.[1,2] A common sign of barbiturate intoxication is a slow coarse nystagmus which appears when the eyes are deviated from the mid position.

While studying the effect of this drug on eye movements, it was noted that in chronic alcoholics intravenous injection of sodium amytal produced fine, shimmering nystagmus. This was a conspicuous and consistent finding. The coarse and slow nystagmoid movement which is often seen in barbiturate intoxication was not present. The difference in response to amytal between the alcoholic and normal individual was so prominent that we felt it warranted publication.

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Material and Method

The ocular statuses of 15 patients with a history of alcoholism were studied before and after intravenous administration of sodium amytal. Those who showed disorders in ocular movements on routine neurologic examination were excluded from the series. A group of 15 psychiatric patients, who manifested no physical or neurologic defects and had no history of alcoholism, served as the control group.

A 5-percent solution of sodium amytal was injected into the antecubital vein at a rate not exceeding 0.1 gm. or 2 cc. per minute. The total dose was never more than 0.5 gm. or 10 cc. During these tests the patients were instructed to fix their gaze on an object away from the central visual axis. Usually the patient was told to maintain his gaze either to the right or to the

left. With the eyes in a deviated position the onset of nystagmus may easily be detected.

Results

(A) Control series

In the control subjects injection of sodium amytal generally produced ocular responses of two types: (1) wide, slow irregular oscillations in which the eyes drifted slowly toward the midline from a point of fixation and returned to the original position with a flick; and (2) coarse, slow rhythmic nystagmus. This nystagmus varied considerably in rate and amplitude but, as a rule, it always remained sufficiently slow so that discreet oscillations of the eyes could be observed.

The following two cases were typical of the control series.

Case 1. D. P., a boy, aged 15½ years, was admitted to the hospital because of a conduct disorder. Physical and neurologic examinations were normal. The eye movements were intact and there was no nystagmus in any position of the eyes.

Sodium amytal, injected into the antecubital vein:

0.1 gm.—produced no nystagmus but as the injection continued coarse nystagmoid jerks were noted.

0.2 gm.—the nystagmoid movements became more prominent.

0.3 gm.—coarse nystagmoid jerks alternated with regular, rhythmic nystagmus of moderate amplitude. This was pronounced on horizontal or lateral deviations. Occasional nystagmoid jerks were also noted on upward gaze.

0.5 gm.—coarse nystagmus present in all directions. In time the coarse nystagmus became evident in all directions. The patient became drowsy five minutes after the injection of the drug and shortly thereafter fell asleep. Usually, when the patient did not fall asleep the nystagmus persisted for over two hours.

Case 2. T. N., a young woman, aged 19 years, was admitted to Bellevue Psychiatric Hospital with the symptoms of a psychic depression.

Sodium amytal was injected intravenously:

0.1 gm.—produced no nystagmus.

0.2 gm.—produced wide nystagmoid jerks on lateral gaze.

0.3 gm.—produced nystagmoid jerks alternating with sequences of coarse nystagmus on right and left lateral gaze. Later there was rhythmic nystagmus of moderate amplitude on right lateral gaze; coarse nystagmus with frequent jerky oscillations on left lateral gaze. In time the difference in the type of nystagmus between the right and left side deviations became reversed. This reversal was found to take place periodically, sometimes at 1- to 2-minute intervals.[1] The patient became drowsy and thick of speech. Her nystagmus lasted for over an hour. The duration of the nystagmus varied with the quantity of the drug injected.

(B) Alcohol group

All the patients in this series showed, on intravenous injection of sodium amytal, a nystagmus which was different from the type observed in the control series. In fact, one patient who denied addiction to alcohol showed fine shimmering nystagmus on injection of this drug. On further investigation it was learned that this patient had previous admissions to this hospital with diagnosis of acute and chronic alcoholism.

Case 3. G. O'C., a woman, aged 53 years, had been drinking for 20 to 25 years and had been admitted to Bellevue Hospital for alcoholism on several occasions. Neurologic examination was essentially negative. There was no spontaneous nystagmus. All eye movements were normal.

Sodium amytal produced, after the injection of:

0.1 gm.—no nystagmus.

0.2 gm.—no nystagmus.
0.3 gm.—rapid, fine "shimmering" nystagmus on lateral gaze.

Further injection, as much as 0.5 gm. of the drug, produced no change in character of the nystagmus. It continued to be fine and rapid. The duration of the nystagmus after injection of the drug was not nearly so long as that observed in the control series.

In most of the alcoholic patients, it was necessary to inject more than 0.3 gm. of sodium amytal before the nystagmus became manifest. It was also observed that the alcoholic suffered less from the narcotic action of the drug than the patient in the control series; the alcoholics were less drowsy than the controls.

Case 4. L. E., a man, aged 56 years, was admitted to Bellevue Psychiatric Hospital with a history that he had been drinking for over 40 years. At one time he was treated for delirium tremens and on two other occasions for alcoholic hallucinosis.

Sodium amytal injected intravenously produced:

0.1 gm.—no nystagmus.
0.2 gm.—inconstant, coarse nystagmoid jerks.
0.3 gm.—inconstant, coarse nystagmoid movements.
0.4 gm.—persistent, coarse, and rapid nystagmoid movements.
0.5 —"shimmering" nystagmus on lateral gaze alternating with coarse nystagmoid jerks.

It was noted that when the nystagmus became persistent it assumed the character of rapidity and shimmering. There were several such instances in the alcoholic series.

Case 5. W. S., a man, aged 32 years, was admitted to the hospital for symptoms of a depression. After a period of observation a diagnosis of "neurotic depression without psychosis" was made. The patient denied alcoholism and claimed that he drank only on occasions. In the course of a psychiatric interview, during which he was under the influence of sodium amytal, "shimmering" nystagmus was observed. This raised the suspicion of alcoholism. While the patient was under the influence of the drug it was learned from him that he had been addicted to alcohol for many years, that he was drunk at least twelve times, and that he was previously admitted to Bellevue Hospital.

Sodium amytal injected on a subsequent occasion disclosed:

0.1 gm.—produced no nystagmus.
0.2 gm.—produced inconstant, coarse nystagmoid jerks alternating with fine "shimmering" nystagmus on lateral gaze.
0.3 gm.—coarse nystagmoid jerks alternating with fine "shimmering" nystagmus on lateral gaze. Later the nystagmus became constantly fine, rapid, and shimmering.

Case 6. J. L., a man, aged 51 years, was not suspected of drinking alcohol. He was originally selected as a control. During the intravenous injection, it was observed that the nystagmus was of the type usually seen when amytal was injected in chronic alcoholics. Further questioning confirmed that he had excessive drinking habits of long standing.

Sodium amytal injected intravenously produced:

0.1 gm.—fine, inconstant nystagmoid jerks on right lateral gaze.
0.2 gm.—fine, inconstant nystagmoid jerks on right lateral gaze.
0.3 gm.—fine, nystagmoid jerks on left lateral gaze. Occasional fine nystagmus on right lateral gaze. The patient's mood changed. He became euphoric and facetious. He claimed he had been drinking for over a year and that he had consumed between 4 and 5 pints of "liquor" a week.
0.4 gm.—rapid almost "shimmering" nystagmus of right lateral gaze. Very fine rapid nystagmus, almost "shimmering," alternating with regular nystagmus of moderate amplitude on left lateral gaze. Very fine nystagmus was noted on up-

ward gaze. The nystagmus in all directions was persistent.

0.5 gm.—"shimmering" nystagmus on right lateral gaze. "Shimmering" nystagmus alternating with fine nystagmoid movements on left lateral gaze. Very fine, almost "shimmering" nystagmus on upward gaze.

Evidently the character of the induced nystagmus helped us to discover that the patient had been an alcoholic.

Discussion

In previous communications the effect of intravenous barbiturates on ocular movements and on various types of nystagmus were discussed. The pharmacologic mechanism for these alterations, however, have not been clearly understood. Spiegel, working with cats, found that amytal produced ocular effects by action on the brain stem as well as on other parts of the brain.

The present observations reveal that alcohol, when imbibed over a long period, alters the function of the nervous system in man. The latter alteration is apparent in reactions of the eyes to intravenous injection of sodium amytal. In the chronic alcoholic there is a shimmering nystagmus rather than the usual coarse rhythmic nystagmus found in the normal individual.* The fine rapid nystagmus is found even months after the patient has stopped drinking. This suggests that alcohol produces more or less of a permanent change in nervous-system function. Whether this change is basically morphologic or chemical is not known. In this connection, we have seen patients with acute and chronic alcoholism who have manifested unmistakable signs of central nervous-system involvement, such as ophthalmoplegias and marked tremors. Yet, on gross and microscopic examination of the nervous system, no definite evidence of a lesion in the brain, or brain-stem, was found. In such cases one was forced to assume that the neurologic signs observed during the period of alcoholic intoxication were due to a chemical (alcohol) which altered nervous-system function, without producing a change in structure, as could be shown by available histologic staining methods.

It would seem probable that the shimmering nystagmus which we find on intravenous sodium amytal in the chronic alcoholic may also be the result of a more or less permanent chemical change in the nervous-system function. This alteration is not necessarily accompanied by a demonstrable lesion in the nervous system. A method which discloses the presence of such an alteration in function is the study of ocular response (nystagmus) to intravenous injection of sodium amytal.

477 First Avenue (16).

* Shimmering nystagmus was also observed in patients with traumatic encephalopathy. However, we have little data to show that intravenous sodium amytal produces an abnormal type of nystagmus in patients with encephalopathies due to causes other than alcohol.

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DIATHERMY TREATMENT OF ANGIOMA OF THE RETINA*

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Angiomatosis retinae is a rather rare condition. Nevertheless, it is one of great interest from the standpoint of diagnosis and also of treatment. Diathermy coagulation has been extensively employed in recent years for the control of many ocular conditions. It seems to be particularly suitable for the destruction of retinal angiomas. In a paper on this subject,[1] presented before the American Academy of Ophthalmology and Otolaryngology in 1942, it was pointed out that only about 145 cases of retinal angioma had been reported in the literature. Since then, reports of the condition have been somewhat more common, leading one to conclude that perhaps the disease is not so rare as we have thought. No attempt is made in this paper to review the literature, as it has been adequately reviewed by Bedell,[2], Lloyd,[3] Cordes and Hogan,[4] and others. This paper is presented to promote the treatment of retinal angiomas by diathermy, to give the "follow-up" on a case operated upon in 1941, and to report another case operated upon in 1944.

A description of the usual fundus findings in angiomatosis retinae is unnecessary before this society as you are already familiar with the appearance of the disease. As Bedell[5] has pointed out, the presence in the retina of greatly dilated, parallel blood vessels usually denotes angiomatosis. However, atypical or far-advanced cases have been confused with Coats's disease, retinoblastoma, aneurysm, endophthalmitis, and several other conditions. Secondary glaucoma and hemorrhage may occur and render the diagnosis extremely difficult.

TREATMENT

Before any local treatment is begun, a thorough general and neurologic examination should be made to rule out involvement of the cerebellum or other organs. Radium applications and roentgen-ray therapy have been used with variable results. However, Cordes and Dickson,[6] in 1943, reported two cases treated successfully by X-ray irradiation. Weve,[7] in 1939, was the first to report the use of surface coagulation and punctures with diathermy. Kaye,[8] in 1941, reported two cases successfully treated in London by a combination of katholysis with surface and puncture diathermy. On April 29, 1941, Fralick[9] performed the first diathermy destruction of a retinal angioma in this country. Without knowledge of Fralick's operation, my first case was done on November 7, 1941, with the assistance of Dr. R. O. Rychener. Guyton[10] reported two cases on which he operated in 1942. One of these patients had a single angioma of one eye which was destroyed by diathermy punctures, with the preservation of normal vision. The other eye of the same patient had multiple angiomas with extensive retinal detachment. The angiomas were successfully destroyed, but no vision was restored.

The localization of the angioma may be done by the same methods as are used for the localization of retinal tears. The technique employed in the diathermy destruction of retinal angiomas is essentially the same as used for retinal detachments and was described in a previous paper.[1] Punctures with micropins into and immediately around the angioma are necessary. In addition to this, a moderate degree of surface coagulation of the sclera is advisable.

In view of the satisfactory results obtained by diathermy, it seems to be the method of choice in single and also in multiple angiomas of the retina. In early cases the prognosis is good for the preservation of useful vision. In advanced cases with ex-

* Presented at the 83rd annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1947.

tensive exudation, degeneration, and detachment, the prognosis for restoration of vision is bad, but the operation is justifiable for preservation of the eyeball, although the latter is not always possible. X-ray treatment may, in certain hands, prove just as satisfactory. Reports of a larger number of cases treated by the two methods and observed over several years, with a final careful analysis of end results, will probably settle this question eventually.

Case reports

Case 1

History. The first case has already been reported and will be discussed here only in the following brief résumé to bring the history up to date. A white man, aged 25 years, was seen first in October, 1941, for refraction because of asthenopic symptoms. He had only recently noticed that the vision of his left eye was poor. He was found to have the typical enormously enlarged vessels and a single angioma far forward in the 3:30-o'clock meridian.

Operative procedure. Operation on November 7, 1941, using Walker micropins, as previously described, succeeded in destroying the angioma and the blood vessels. Vision in this case was only 8/200 before operation. This poor vision was due to the very extensive exudates, or deposits of lipoid material in the macula and surrounding retina. Following operation, vision did not improve. It remained the same for about one year, but had gradually become reduced to 2/200, due to extensive degenerative changes and scar tissue formation.

Course. The fundus picture had remained practically unchanged for the past several years. No trace remained of the large artery and vein, but along their former course, in the region of the equator, newly formed blood vessels and fibrous tissue extended forward into the vitreous to a height of about 6 diopters. When last examined (April, 1947), two small spots of hemorrhage were visible in that area, indicating that perhaps a very quiet form of proliferating retinitis was still going on. Dense scar tissue occupied the site of the former angioma. The general condition of the patient had remained excellent. The eye appeared a little smaller than the other and a scarcely noticeable exotropia was present.

Case 2

History. Mrs. M. P., a white woman, aged 34 years, was first seen in August, 1944, on one of the medical wards of the John Gaston Hospital. She had noticed for about two weeks that vision of her left eye was blurred, but she was confined to the Hospital to find the cause of severe headaches which had been present for three days before admission. The patient had been admitted to the Hospital for various ailments over a period of 12 years. Only one of these conditions was of particular interest. In June, 1944, an exploratory laparotomy had been performed. A small cyst of the pancreas was found and removed. It measured 20 by 8 by 2 mm. Microscopic section showed it to consist of a fibrous tissue wall with a low columnar cell lining. It was not an angioma. The family history was also interesting: her father died of a brain tumor (type unknown) at the age of 36 years. Her daughter died of a tumor (cerebellar cyst) at the age of 17 years, and one of her sisters died of a brain tumor. (None verified by autopsy.)

Physical examination. Complete general physical and laboratory examinations were negative and the consulting neurosurgeon found no evidence of cerebellar or other intracranial involvement. The right eye was normal and the vision, 20/20. The left eye was normal except for the fundus findings. The disc was slightly swollen with blurred borders. Below the disc, two very large blood vessels coursed tortuously downward and forward to a tumor mass in the 6-o'clock meridian, between the equator and the ora serrata. The tumor mass was about 1¾ times the size of the optic disc and of a light reddish brown color. There was no

separation of the retina, and none of the degenerative changes which had been so abundant in the first case. Vision was reduced to 20/100.

Operation. On September 6, 1944, operation was performed at the Memphis Eye and Ear Hospital. The procedure used was essentially the same as that used in Case 1. The conjunctiva, Tenon's capsule, and the inferior rectus muscle were separated from the sclera and retracted downward. One Walker micropin was placed on each side of the 6-o'clock meridian just anterior to the equator. Ophthalmoscopic examination showed these pins to be located just at the posterior border of the angioma. Micropins were then placed on either side of the tumor and the entire area between these 4 pins extending forward to the ora serrata was studded with punctures. A total of 15 Walker pins was used with 45 ma. of current. Surface diathermy was not applied in this case. No hemorrhage occurred during the operation.*

Postoperative Course. On the second postoperative day, there was a retinal detachment present. This gradually increased until on the 16th day it covered the entire lower half of the eye and obscured all but the upper border of the disc. In the meantime, numerous hemorrhages had occured into the retina and it was impossible to find any definite tears, but a disinsertion was thought to be present. On the 20th day after the first operation, a second diathermy procedure was performed. A barrage of micropins was inserted to surround the site of the angioma. Surface diathermy was also applied. Sclerotomy with a Graef knife released a considerable amount of clotted blood. Following this procedure, the vitreous was very hazy with blood so that for some time the fundus could not be seen. After another four weeks in bed, the patient was sent home with pinhole spectacles and with a

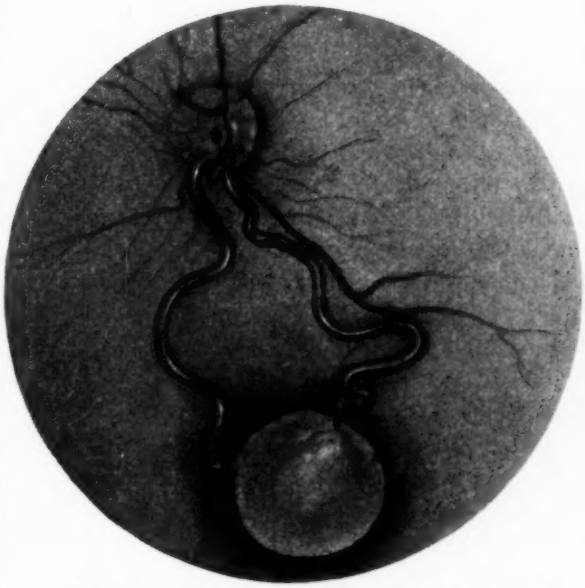

Fig. 1 (Lewis). *Case 2.* Preoperative appearance.

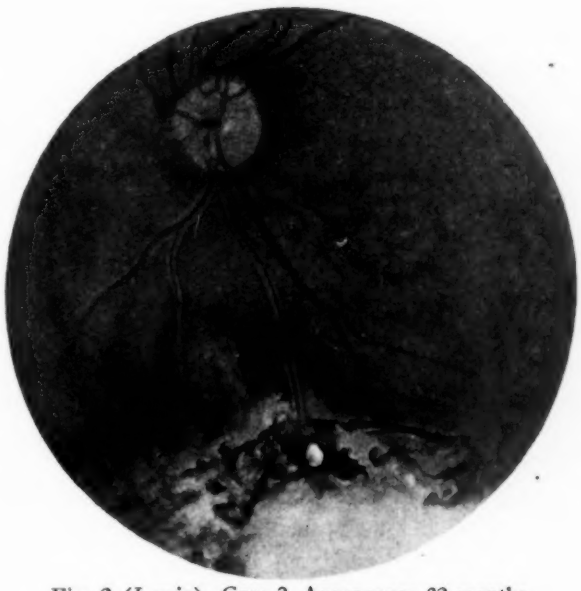

Fig. 2 (Lewis). *Case 2.* Appearance 32 months postoperatively.

* Dr. George Kambara, of Madison, Wisconsin, former resident in the Memphis Eye and Ear Hospital, assisted in the operation and management of Case 2.

rather gloomy prognosis. Iodides given internally, and the passage of time gradually cleared the vitreous. However, it was five months after operation before fundus photographs could be made. Even then they were indistinct. At that time the disc was fairly normal. The vessels were smaller. There was a rather diffuse pigmentation of the retina and the site of the angioma appeared quite red, but no details were visible. Vision was 20/100. The patient was not seen again until July, 1945. Vision was then 20/40 and the fundus could be seen fairly clearly. The angioma seemed to be completely destroyed. Its former site and the entire surrounding retina were pigmented and scarred. The vein appeared as a small column of blood which stopped just anterior to the equator. The artery was rather large and extended from the disc into the scar anteriorly. Both vessels were surrounded by fibrous sheaths. There was no evidence of tumor recurrence, but the patent artery made the final result seem somewhat doubtful.

Outcome. When next seen in February, 1946, vision had improved to 20/30 and J2. White atrophic spots, pigmentation, and very irregular scar tissue occupied the lower anterior one sixth of the fundus. The vessels were slightly smaller. Final examination on April 21, 1947, showed the vision to be 20/30, corrected with a +0.75D. cyl., ax. 90° to 20/20. Near vision was J1 with normal accommodation. The eyes functioned normally and the patient was unaware of a rather large defect present in the upper visual field. There was a definite flattening of the eyeball below, probably due to contraction of the sclera from coagulation. The vitreous was perfectly clear. The fundus was normal except for the extensive irregular scarring and the peculiar vessels. The blood columns were smaller, the fibrous walls thicker and whiter. The vein stopped at the equator, but the artery ran forward into the temporal side of the scar.

Almost three years have elapsed without recurrence of the growth and with great improvement of ocular functions. She still has occasional severe headache and recently (March, 1947) underwent pneumoencephalography, with negative results.

Comment. In retrospect it seems that failure to use surface coagulation in this case, at the time of the first operation, was a mistake. It might have prevented the necessity of the second operation. It is quite possible that 45 ma. of current is too much to use and that less scarring would result from a smaller amount. A smaller reaction without any hemorrhage would be ideal and may be possible with more experience.

Summary and Conclusions

Two patients with angiomatosis retinae were treated by diathermy coagulation and observed for 5½ years and 3 years respectively.

The first was an advanced case and while the angioma and large vessels were destroyed and the eyeball preserved, vision was not restored. The second case was early. The angioma was destroyed and normal vision was present after 34 months.

Due to the progressive nature of angiomatosis retinae it seems that all cases uncomplicated by intracranial or other serious involvement should be given the benefit of some type of treatment to destroy the tumors. Diathermy offers the best method for single angiomas, particularly when located far in the periphery. It is felt at present that the combination of surface diathermy along with multiple punctures into and around the angioma is, in the majority of cases, the procedure of choice.

130 Madison Avenue (3).

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GLAUCOMA ASSOCIATED WITH SUBLUXATION OF THE LENS IN SEVERAL MEMBERS OF A FAMILY*

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Ectopia lentis, or familial displacement of the lens, is most frequently manifested as a bilateral, symmetric displacement of the lens due to defects in the zonular fibers. Partial or complete luxation of the lens occurs and is frequently complicated by a secondary glaucoma. Falls and Cotterman,[1] in 1943, reviewed a family of 157 members, 24 of whom had ectopia lentis. Thirteen of these 24 members developed glaucoma; no case of glaucoma was found in the nonaffected group.

It has long been recognized that glaucoma may be associated with changes of the lens. Following the classification of Parker Health,[2] glaucoma may arise either (1) when the lens is in position or (2) when it is displaced.

Under the first heading, we can include microphakia, glaucoma capsulare, and increase in the lens bulk. In microphakia, the associated glaucoma has its onset in youth and takes the form of acute attacks. Glaucoma capsulare, or desquamation of the lens capsule, may cause glaucoma by toxic, irritative, and mechanical methods. An increase in lens bulk may press on the ciliary body and cause an irritative process leading to blocking of the filtration angle.

In the second group are found both partial and complete luxation of the lens, whether due to congenital weakness of the zonule or to trauma. In ectopia lentis, or luxation of the congenital type, the lens sometimes comes in contact with the ciliary process and gives rise to an irritative vasomotor reaction. Local edema causes a forward displacement of the lens and blocking of the angle of the anterior chamber by the root of the iris. Complete dislocations of the lens, either into the anterior chamber or the vitreous body, are frequently followed by glaucoma.

This paper presents the case reports of two brothers and an analysis of the histories of the other members of their family.

Case reports

Case 1. L. O., a white man, aged 55 years, was seen in September, 1941, complaining of pain in the right eye of three days' duration. His left eye had been enucleated in 1938 for absolute glaucoma. The tension of the right eye was hard to fingers, the cornea was steamy, the pupil was fixed. Treatment with ¼-percent eserine drops produced only partial relief from the pain. Twelve hours

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later an iridectomy was performed. The iridectomy relieved the severe pain, but the tension remained above normal and treatment with pilocarpine solution was necessary from 1941 to 1944. Refraction of the right eye was: −1.75D. sph. ⌒ −1.0D. cyl. ax. 100° = 20/50−1.

On February 8, 1944, the patient bumped his head against another worker. This caused the rays to proceed "up" when reflected from objects, rather than "down as previously." Objects appeared upright and normal to him. There was no pain, and he could see to get around. He realized that he had dislocated the lens of his right eye. Examination four days later showed an oily translucent mass in the anterior chamber of the right eye. The eye was not tender and the tension was normal to palpation. The lens was removed on February 15th by loop extraction, little vitreous being lost. Recovery was satisfactory and on April 11th the right eye was white and quiet with normal tactile tension. Glasses were prescribed: O.D., +10.5 D. sph. ⌒ +3.5D. cyl. ax. 30° = 20/30.

This patient with glaucoma and dislocation of the lens responded satisfactorily to treatment when the lens was removed, and the good visual result has since been maintained.

Case 2. C. O., aged 54 years, the brother of L. O., was first seen on May 5, 1947. About six weeks previously the vision of the left eye had become blurred and his optometrist had found the eye had become more myopic. For three weeks his left eye had pained and he had noticed rings about the lights.

Vision was: O.D., 20/20; O.S., 20/200 correctible to 20/60 with a −3.75D. sph. ⌒ −1.25D. cyl. ax. 110°. Tension was O.D., 19 mm. Hg; O.S., 65 mm. Hg (Schiøtz). The right eye was normal. On the left side, the conjunctiva was injected, the cornea was steamy, the anterior chamber was almost completely filled with the lens which projected through the pupil. The right pupil was round, 2 mm., reacted to light and accommodation, consensually and directly. The left pupil was oval, 7 mm., and did not react. The fundus was hazy and no gross pathologic condition was seen.

He was treated with neosynephrine (10 percent) drops to the left eye. On May 6th, the tension was 30 mm. Hg, but the next day it was 70 mm. On May 9th, an intracapsular extraction of the left lens was done, with a peripheral iridectomy. The tension at the time of operation was 70 mm. Hg. At the first postoperative dressing there was a prolapse of iris at the 1-o'clock position. This was excised and the wound healed well. A month later refraction was O.S., +10.5D. sph. ⌒ +2.D cyl. ax. 30° = 20/30. The field was normal for 5/330 white test object. The tension has stayed normal since the operation.

Family history

Grandmother A. The first member of the family of which we have any record became blind at the age of 43 years from bilateral glaucoma. She had eight children, of whom five were affected, as follows:

M. O. This was the mother of L. O. At the age of 52 years she had an operation for glaucoma on her left eye, and four years later a cataract was removed from that eye. When 65 years old, her right eye was operated on in St. Michael's Hospital, Toronto, for glaucoma with secondary cataract. It is recorded that prior to operation, the lens was dislocated into the anterior chamber.

M. W. This was an aunt of L. O. She suffered, at the age of 46 years, an acute attack of glaucoma in the right eye, for which an iridectomy was performed. At 50 years of age, a right cataract was removed, and it was noted that an incipient cataract was present in the left eye.

T. A. This is an uncle of L. O. When 37 years of age, his right eye was operated on for glaucoma. There is no further report on this eye until at the age of 60 years, it was said to be blind. Five years later, Dr. A. B. Ritchie, of Guelph, Ontario, noted long-

standing glaucoma in the left eye with vision reduced to light perception only. An iridectomy was performed and some vitreous was lost at operation. The vision is now light perception only.

C. A. This was an uncle of L. O. He was known to have glaucoma, but no further information is available.

glaucoma in the right eye. The eye did not respond to miotics, but on instillation of a 1:100 solution of adrenalin, the tension dropped and the pupil dilated to reveal a dislocated lens. A basal iridectomy with extraction of the lens was done. Subsequent vision was 20/20.

One year later, acute glaucoma, which did

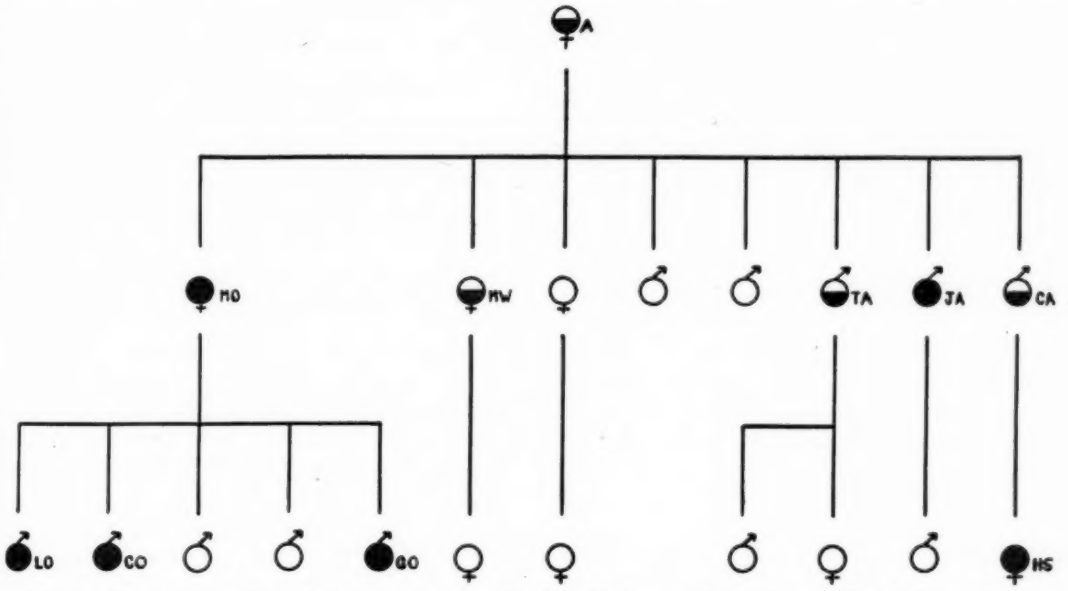

Fig. 1 (Harshman). Genealogic tree of a family in which several members suffered from glaucoma associated with subluxation of the lens. Half-blocked circles represent patients with glaucoma. Fully blocked circles represent patients with glaucoma and dislocated lenses.

J. A. This was an uncle of L. O. He has had eye trouble since the age of 40 years, and is known to have dislocated lenses. There is no medical report available.

Third generation

In the third generation, four members of the family are known to have dislocated lenses and glaucoma.

L. O. This case has been described above.

C. O. This case has been described above.

G. O. A brother of L. O. Dr. Gerald Spero, of Detroit, Michigan, states that the patient's first complaint was one of increasing myopia. At the age of 36 years, refraction was: −6.0D. sph. O.U. = 20/20; the tension and fields were normal. Six months later, the patient suffered an acute attack of not respond to miotics or strong adrenalin, developed in the left eye. Dr. Kronfeld, of Chicago, did a basal iridectomy on the left eye. It was noted after operation that the left lens was dislocated. Nine months later, a loop extraction of the dislocated lens was done, and vision of 20/20, with correction, was obtained.

H. S. This is the daughter of C. A. and a cousin of L. O. When aged 42 years, she noticed a loss of vision for distant objects, and was told she was near-sighted. Glasses were prescribed. The glasses were changed a year later, and shortly after that Dr. Ruedemann, at the Cleveland Clinic, made a diagnosis of glaucoma. A few months later, the patient suffered an acute attack of glaucoma in the left eye, which was relieved by an

iridectomy and extraction of the dislocated lens. In the same year, she suffered an acute attack of glaucoma in the right eye. Iridectomy and extraction of the lens was again done. Dr. Ruedemann reports that the operation on the right eye was more successful than that on the left.

Comment

Stokes[3] has reported a family of five generations exhibiting glaucoma, and has reviewed the literature regarding hereditary glaucoma. He finds that the hereditary disease is usually chronic in form, and that permanently good results are obtained by a fistulizing operation, iris inclusion operation, or the Elliot trephining operation.

The family herein reported carries a hereditary tendency to glaucoma. Of the 10 members exhibiting the disease, 6 had dislocated lenses, and a 7th had an incipient cataract. Four patients showed a sudden increase in myopia prior to the appearance of the hypertension. Thus, the glaucoma is intimately associated with dislocation of the lens. The glaucoma exhibited its first clinical manifestations in the 4th to 6th decades, and its onset was acute in several of the cases.

Therefore, this series of cases does not belong in the usual group of hereditary glaucoma. They show a type of glaucoma secondary to a pathologic condition of the lens, whether it is faulty position causing a mechanical obstruction of the angle, or some irritative process of the ciliary body. For these reasons, the usual glaucoma operations fail to give complete relief.

Summary

A family, which contains many cases of glaucoma associated with subluxation of the lens, is presented and discussed. The disease, in this group, does not respond to the usual medical or surgical treatment for glaucoma, but is only permanently controlled by removal of the lens. Such cases should be remembered because they indicate that subluxation of the lens may be a factor in cases of glaucoma which do not respond to the ordinary operations.

I wish to thank Dr. R. J. P. McCulloch and Dr. Clement McCulloch for their kind permission to quote the case histories of patients L. O. and C. O.

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THE OCULAR EFFECT OF SEVERAL IRRITANT DRUGS APPLIED DIRECTLY TO THE CONJUNCTIVA*

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The aim of this work is to compare the immediate and delayed effects of a variety of irritants on the cornea—a tissue normally devoid of blood vessels—with their effects on the vascular tissues of the sclera and eyelids.‡

Method

The observations were made on white rabbits, unless otherwise stated. The substance, as powder or dissolved in 0.7-percent solution of sodium chloride, was placed in the lower conjunctival sac of one eye and held there usually for one-half minute. This was repeated at intervals of one or several days, if necessary. The other eye was treated with 0.7-percent solution of sodium chloride and used as a control. The eyes were examined for evidence of inflammation, and changes in the corneal structures were observed with the biomicroscope.

Results

The reactions observed after the application of several substances are the following:

1. Anthraquinone

This drug, applied to the eyes as a dry powder, daily for several times, produces only immediate sensory and inflammatory reaction (discomfort, blepharospasm, and conjunctival congestion) that disappears very soon. The eyes appear normal in a few hours, and the conclusion is that the anthraquinone produces these reactions by the mechanical contact of the powder, which is almost insoluble in the eye secretion.

2. Arsenic trioxide

The arsenic was applied as dry powder or saturated solution. The saturated solution, prepared with cold saline solution, is too dilute to produce either immediate sensory or acute or delayed inflammatory reaction. The dry powder, when applied once in very small quantity, produces only discomfort, blepharospasm, and lacrimation. The increase of the ocular secretion washes the drug from the eyes, and does not produce inflammatory reaction. When it is applied for several days (once daily during three days) or in moderate quantity, it produces immediate discomfort, lid spasm, miosis, acute inflammatory conjunctival reaction (distended vessels, large hemorrhage, and thrombosis), and marked edema of the lids. These conditions increase in 24 hours. The cornea soon turns opaque, and a purulent secretion appears. If the epithelial corneal alteration is not severe and the conjunctival vessels around the limbus are not necrosed, a vascular invasion of the cornea from all parts of the limbus begins in a few days (fig. 1B).

If the corneal lesion is slight, it is very soon repaired; if it is severe, a perforation may be produced in a week followed by recovery, or by phthisis bulbi in 20 days if the dose of the drug was high. When the dose is very great (almost filling the lower conjunctival sac with the dry powder), the acute inflammatory reaction is more violent, the edema of the lids increases in a short time and encloses the drug, which is almost totally absorbed so that the animals die from the systemic arsenic effects before

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‡ I am indebted to Dr. Torald Sollmann, professor emeritus of pharmacology, for the guidance and criticism, and to Dr. Lorand V. Johnson, assistant professor in ophthalmology, for checking the interpretation of the ocular lesions.

there is time to develop intense alterations in the ocular structures.

The events produced by moderate dose of arsenic trioxide appear similar to those described by Uhde[1] for B-chlorovinyl-dichlorarsine or Lewisite.

The damage to the nonvascular cornea as a dry powder and in saturated solution. With the dry powder, a single application is irritant and produces immediate sensory reaction, discomfort, blepharospasm, and conjunctival hyperemia. Edema appears with watery secretion on the day following the application, but the cornea is clear and in

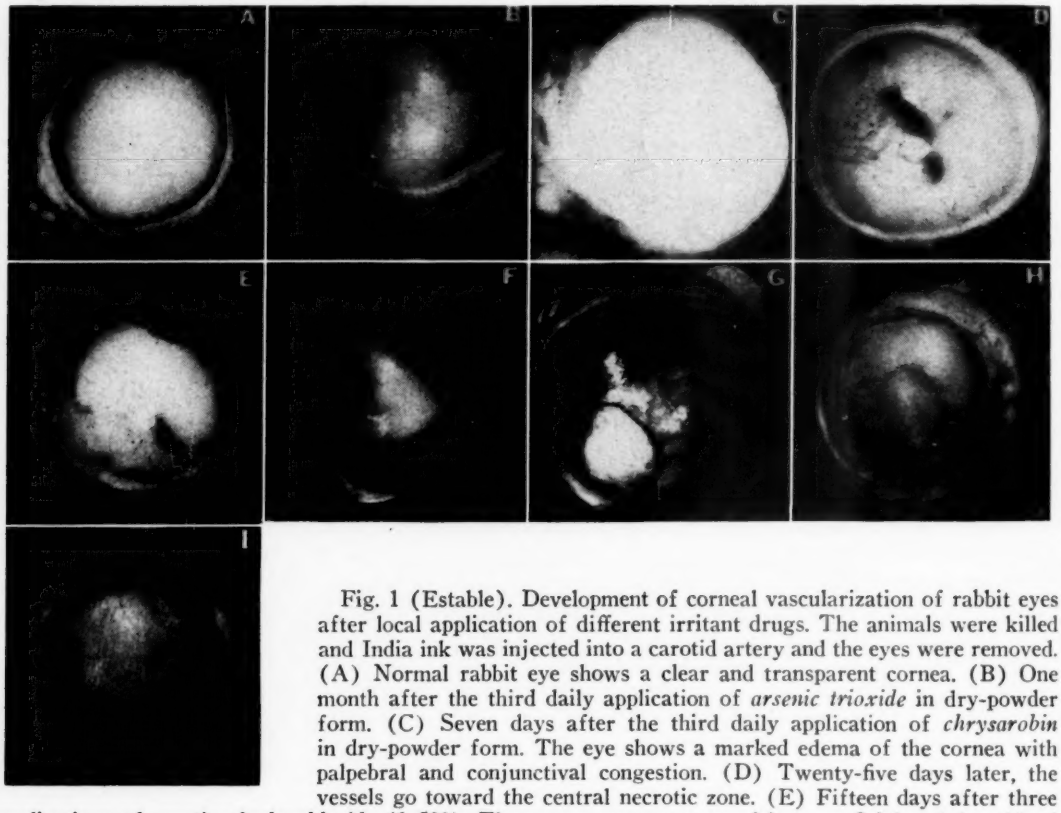

Fig. 1 (Estable). Development of corneal vascularization of rabbit eyes after local application of different irritant drugs. The animals were killed and India ink was injected into a carotid artery and the eyes were removed. (A) Normal rabbit eye shows a clear and transparent cornea. (B) One month after the third daily application of *arsenic trioxide* in dry-powder form. (C) Seven days after the third daily application of *chrysarobin* in dry-powder form. The eye shows a marked edema of the cornea with palpebral and conjunctival congestion. (D) Twenty-five days later, the vessels go toward the central necrotic zone. (E) Fifteen days after three applications of *emetine hydrochloride* (1:500). The cornea appears covered by superficial and deep blood vessels extending from sclerocorneal limbus to the central necrotic zone. (F) One month later, the blood vessels are well marked and the central zone of the cornea appears more clear. (G) Forty days after a single application of *quinone* in dry powder. The perforation was produced in 18 days. (H) Ten days after a single application of *quinone* in saturated solution. The eye shows a marked corneal necrosis with vascular proliferation on the conjunctiva as well as corneal invasion. (I) Forty days after a single application with *resorcinol* in dry-powder form.

shows that arsenic trioxide acts directly on the cells when it is applied topically in powdered form in moderate or great quantity, and not merely indirectly by the action of the drug on the capillaries.

3. Chrysarobin

This substance is very slightly soluble in water and in saline solution. It was applied four days the eyes appear to be normal.

A second application produces the same immediate and acute reaction, but the repetition of the applications, daily for several days, causes a severe inflammation. In the first few days, an ocular and palpebral conjunctival vascular reaction occurs, with increase of the ocular secretion. On the day after the third application, the cornea is

edematous and opaque, and the conjunctiva shows intense inflammation (conjunctivitis or keratitis), corresponding to the violent vascular conjunctival reaction described by Igersheimer.[2] Vascular invasion into the cornea begins in a few days, and depilation of the lids in a week. The saturated solution does not produce sensory, acute, or delayed reactions in the ocular structures, during or after several daily applications.

In conclusion, the chrysarobin in saturated solution does not produce any effect because of the slight solubility of the drug. A single application as dry powder causes immediate sensory and inflammatory reaction followed by acute conjunctivitis (hyperemia, edema, and watery secretion) that almost disappears in four days. Repeated daily applications result in marked irritant local reaction with intense edema of the cornea, conjunctiva, and lids, and vascular invasion of the avascular membrane (figs. 1C and 1D).

4. Colchicine

A dilute solution of colchicine (1:5,000) applied locally, daily for several days, does not produce immediate sensory or acute and delayed inflammatory reaction. Solution of 1:2,000 does not produce sensory reaction, but only a very slight hyperemia of the conjunctiva that disappears very soon. Daily applications produce the same effect. Solution of 1:1,000 produces only slight conjunctival congestion that disappears before 24 hours. Solution of 1:500 results in vascular conjunctival inflammation (hyperemia, vasodilatation) that is apparent 24 hours after the application and increases after the second and third application but without corneal modifications. The hyperemia has almost disappeared in 48 hours after the last application; and in four days the eyes are practically normal.

The same solution, applied every day for 10 days, also produces the same reaction, which does not progress and is very similar to the aspect of the first days. With strong solution (1:100), the vascular conjunctival reaction appears in a few hours and, after the third application, the cornea turns opaque and a vascular corneal invasion begins in a few days.

These alterations soon disappear and, in a few days only, the main vessels persist on a transparent cornea. For the increase and persistence of the corneal vascular reaction, more daily applications are necessary. When the dry powder is applied, immediate lacrimation, blepharospasm, and acute conjunctivitis appear; in 24 hours, the conjunctival congestion increases and extends to the iris, and slight edema of the palpebral conjunctiva develops. The eye is more closed than normally (photophobia?). The conjunctival congestion persists for 48 hours only, and in six days the eyes show corneal vascularization. The cornea remains almost clear throughout.

In conclusion, the eye symptoms shown by colchicine in dilute solution are slight and of short duration; a strong solution or dry powder produces an inflammatory reaction, with vascular invasion only if it is applied daily for several days.

5. Emetine hydrochloride

The irritant local action of the emetine on the conjunctiva was first pointed out by Lowin[3] and lately confirmed by Walters and others,[4] but their reports do not describe reactions in the nonvascular tissue (cornea). In two clinical cases, when a 4-percent emetine solution had accidentally splashed into the eyes, Blue[5] reports no immediate pain, but a few hours later "there is an uncomfortable scratchy feeling, intense photophobia, and lacrimation with conjunctival and circumcorneal injection."

The drug was placed into the conjunctival sac in various concentration, and one, two or more applications were made with intervals of one day. The immediate, acute, or delayed inflammatory reactions vary with the concentrations. Even a 1:50 solution does not produce an immediate sensory effect. The

application of a 1:10,000 solution, daily for several days, does not produce inflammatory effects. A 1:5,000 solution produces a slight conjunctivitis, 24 hours after the second application, that disappears very soon. With a more concentrated solution (1:2,000 and 1:1,000), the ocular and palpebral conjunctiva shows intense and prolonged congestion and a little edema but the cornea shows no changes, the local inflammatory reaction being confined to the vascular tissue.

The application of a 1:500 solution for three consecutive days is followed by intense conjunctivitis (hyperemia and vasodilatation), increase of the purulent ocular secretion, cloudiness of the cornea, and formation of new vessels in the conjunctiva, with coreal vascular invasion in a few days. With a 1:100 solution, conjunctivitis appears promptly and increases in 24 hours, with edema formation and purulent secretion. With a 1:50 solution, the immediate conjunctivitis increases rapidly, and edema and abundant purulent secretion are present in 24 hours. This picture remains unchanged for several days but, about the fifth day, cloudiness of the cornea appears and in seven days the cornea shows small vessels; in nine days, the skin of the lids is reddened and edematous and its depilation is evident.

The vascular invasion may become very great so that the vessels cover almost the entire surface of the cornea, leaving a small central necrotic zone free. The condition remains much the same for many days. Some 40 days after the last application, the corneal lesions begin to progress toward repair, and the vascular reaction disappears. In about two months the eyes usually recover without permanent damage and have normal aspect. A progressive development of corneal inflammatory reaction, after three applications of a solution 1:500, is shown in Figure 2.

The conclusion is that emetine hydrochloride produces a powerful and irritating local reaction on the eyes when relatively dilute solutions are applied for a few days. These begin in the vascular structures and progress to the nonvascular. The intensity and time of appearance of the irritating effect are related to the concentration of the solution and to the frequency of the application. These irritating actions are in contrast with the absence of immediate sensory effect.

6. Histamine biphosphate

A solution of histamine biphosphate (1:200) produces immediate sensory reaction, with slight acute conjunctival vasodilatation that disappears very soon. Dry powder produces discomfort, blepharospasm, lacrimation, and prompt vasodilatation, but these symptoms also disappear in a few minutes. Daily applications during several days produce the same effects. The slight conjunctival reaction with relatively concentrated solutions in rabbits is in contrast to the potent vasodilator effect produced in the human eye by 1:40,000 and 1:50,000 solutions as Gartner[6] shows in the photograph of blood vessels of the conjunctiva. Rabbits, therefore, appear relatively tolerant to action of histamine in this location.

7. Paraphenylenediamine (orsin)

The dry-powder form of this drug applied in the conjunctival sac produces immediate signs of discomfort or pain, lacrimation, blepharospasm, and a vascular conjunctival inflammatory reaction resembling allergic conjunctivitis, with promptly increasing palpebral edema. However, it does not produce any persistent alteration in the cornea and conjunctival membranes, even when the drug is applied several times. With a saturated solution, no immediate sensory reaction is observed, but the vascular conjunctival reaction appears immediately after the instillation of the drug, increases in a few minutes, and disappears very soon. This contrasts with the clinical reports of corneal ulceration, ophthalmia, and permanent blindness occurring in connection with its use as a brown dye for hair and fur.[7–12] However, these appear to involve individual allergic

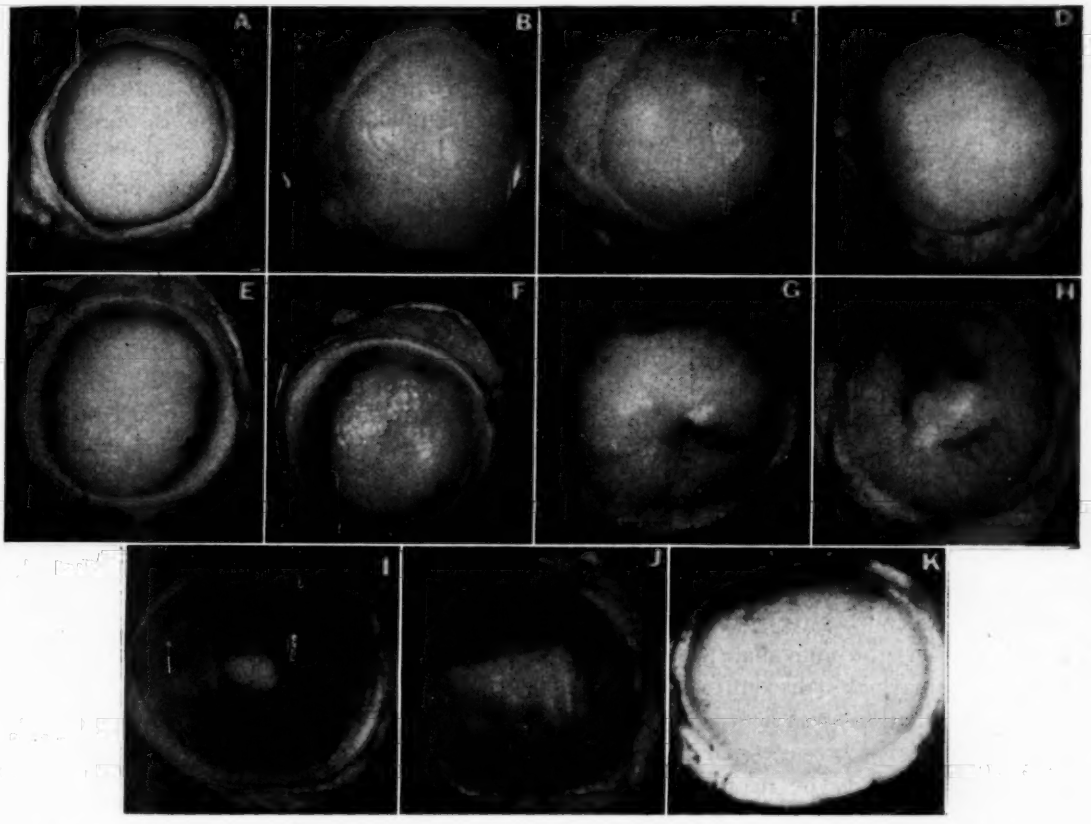

Fig. 2 (Estable). Progressive development of corneal inflammatory reaction of rabbit eyes after three applications of a solution (1:500) of *emetine hydrochloride*. The animals were killed and India ink was injected into a carotid artery and the eyes were removed. (A) Normal rabbit eye, the cornea is clear and transparent. (B) Twenty-four hours after the first local application. The sclera and palpebral conjunctiva are congested, but the cornea appears normal. (C) In 48 hours (24 after the second application) the conjunctivitis has increased. The cornea has lost its normal luster and appears slightly opaque. (D) In seven days, the superficial blood vessels around the limbus begin to extend into the edematous and rather opaque cornea. (E) In nine days, the aspect of the cornea is almost the same. (F) In 12 days, the corneal vascular invasion increases and a complete circular pannus appears. The corneal edema has spread, and superficial ulcerated zones are present. (G) In 15 days, the cornea shows the progressive advance of the vascular invasion. The superficial and deep blood vessels are extended on the opaque cornea toward the central necrotic zone. (H) In 20 days, the circular pannus is very regular. The large superficial vessels cover almost all the corneal membrane from the limbal plexus, leaving free only the central ulcerative zone. (I) In 25 days the cornea shows a similar aspect. (J) One month after the edema of the cornea has entirely disappeared, the opacity is relatively slight. (K) In 40 days, the cornea is much improved; the opacity has disappeared entirely, and the blood vessels are also rapidly disappearing.

susceptibility.

In conclusion, paraphenylenediamine, when applied to rabbit eyes, produces an inflammatory reaction resembling allergic conjunctivitis.

8. Podophyllin

This substance is very irritating to mucous membranes and eyes. Applied on the eyes as a dry powder, it produces immediate discomfort, blepharospasm, lacrimation, conjunctival vasodilatation, and edema that increase promptly. In 24 hours, the conjunctival congestion and the edema are very marked; in 48 hours, the cornea is slightly clouded and vascularization appears in five days. In 25 days, the cornea is normal. In conclusion, podophyllin in dry powder form

produces immediate sensory and inflammatory reactions that progress very rapidly.

9. Quinone

This has a very irritating action on the membrane of the eye when it is applied in powdered form and in solutions that are not too dilute. The 1:10,000 solution, applied daily for several days, only produces sensory reactions. These reactions are greater with 1:5,000, but without inflammatory effects. The 1:1,000 solution produces acute conjunctivitis (vasodilatation, edema, and purulent secretion) that disappears in some days. With daily applications it is more persistent, but always remains limited to the vascular membrane. With 1:500 solution, cloudiness of the cornea appears in 24 hours and its vascular invasion begins in four days. With a dry powder, the immediate sensory reactions are marked (discomfort, blepharospasm, lacrimation) and acute conjunctivitis appears in a few minutes. Marked edema and corneal opacity by necrosis is present before 24 hours, persists for a long time, and perforation of the cornea may result (figs. 1G and 1H).

In conclusion, quinone in different concentrations produces ocular reactions that grade from slight immediate sensory reaction with 1:10,000 solution, to violent conjunctivitis (vasodilatation, edema, purulent secretion), and marked necrosis of the cornea with the application of a dry powder.

The harmful ocular effects of quinone vapors were reported by Sterner, Oglesby, and Anderson.[13]

10. Menadione (2 methyl 1-4 naphtohoquinone)

Instillation of an aqueous solution of the bisulfite (1:1,000) produces immediate sensory reaction (discomfort and blepharospasm) with conjunctival congestion that disappears very soon without any evidence of injury. New applications produce the same effects.

11. Resorcinol

No immediate, acute, or delayed effects are produced by a 1:1,000 solution, even when applied daily during several days. With a solution of 1:100, slight blepharospasm and conjunctival congestion appear immediately but are of short duration and, in a few hours, the eyes present a normal appearance. Daily applications during several days produce the same effects. With a 1:10 solution, immediate sensory reaction is present, and clinical conjunctival inflammation with cloudiness of the cornea begins a few seconds after the instillation is started. A purulent secretion appears in 24 hours, and vascular invasion of the cornea begins in four days (fig. 1I). The application of the drug in dry powder form produces immediate discomfort and results in necrosis of the cornea, generally followed by perforation. If the necrosis is not very marked, a vascular invasion of the cornea develops.

General discussion

The irritant ocular reaction produced by the different substances herein reported may appear on the conjunctival structures alone, or on the conjunctival and ocular membranes, successively or simultaneously, but with different intensity and with a different type of reaction.

The clinical manifestations produced by the drugs studied are:

1. Immediate sensory irritant reactions—discomfort, blepharospasm, photophobia, and lacrimation.

2. Acute and subacute inflammatory reactions—hyperemia, vasodilatation, hemorrhage, edema, purulent secretion, and necrosis.

3. Delayed inflammatory reactions—corneal opacity, vascularization, necrosis, ulceration, and perforation of the cornea.

This clinical picture is not characteristic of any one drug. Several drugs may produce identical effects; and a given drug may produce them only in part, depending on (1) *Physical state* (all the drugs in powdered

form produce immediate sensory and acute reactions); (2) *Concentration* (very dilute solutions do not produce any apparent effect; for instance, arsenic trioxide and chrysarobin in saturated solutions; emetine (1:10,000); quinone (1:10,000); resorcinol (1:1,000); (3) *Time of contact* and *frequency of applications* (the clinical ocular picture with colchicine (1:100) is evident after the third application).

The actions of different drugs are influenced by their chemical affinity for the proteins of ocular membranes, by their physical adsorption,[14] and possibly by destruction or inhibition of enzyme systems in the cornea.

Some drugs produced delayed effect with sensory and inflammatory reactions, others acute inflammatory reactions without delayed effects; some produce only irritant sensory reactions but not lasting inflammatory changes and, finally, others show acute inflammation or acute followed by delayed effects without sensory reactions.

Some drugs produce only a vascular effect (anthraquinone, histamine, menadione, paraphenylenediamine); others cause both vascular and nonvascular changes, as illustrated by direct and indirect corneal alterations.

According to the intensity as well as qualitative effect produced by local application of different concentrations to the ocular structures, the different drugs that were studied may be classified in groups in order of potency:

1. Drugs without apparent effects in the following concentrations: arsenic and chrysarobin in saturated solution, colchicine (1:1,500), emetine (1:10,000), quinone (1:20,000), resorcinol (1:1,000).

2. Drugs that produce only immediate sensory reaction: anthraquinone and arsenic trioxide in powder and in small quantity; quinone solution (1:10,000 and 1:5,000).

3. Drugs that produce immediate sensory reactions followed by acute inflammatory effects: anthraquinone, chrysarobin, and paraphenylenediamine in dry powder, histamine (1:200), quinone (1:1,000), menadione (1:1,000), resorcinol (1:100).

4. Drugs that produce immediate sensory reactions followed by acute and delayed inflammatory effects: arsenic trioxide, chrysarobin (repeated daily applications), colchicine, and podophyllin in dry powder, quinone (1:500), resorcinol (1:10).

5. Drugs that produce only acute inflammatory reactions: colchicine (1:2,000, 1:1,000, and 1:500), emetine (1:5,000, 1:2,000, and 1:500), paraphenylenediamine in dilute solution.

6. Drugs that produce acute inflammatory reactions followed by delayed inflammatory effects: colchicine (1:100) (repeated daily applications), emetine (1:500, 1:100, 1:50).

Corneal turbidity as well as increase of the limbal capillaries appear to be necessary preliminaries to vascular invasion of the cornea. The destruction of the epithelium is followed by a secondary fibroblast formation, which facilitates the vascular progression. The turbidity of the cornea is related to the epithelium destruction or to the interstitial edema formation. Severe corneal necrosis does not produce vascular reaction, because the limbal blood vessels are necrosed. The opacity of the cornea and its vascularization are not specific of any drug. Every irritant substance that increases the capillary blood vessels of the ocular limbus and produces turbidity of the cornea may be followed by the vascular invasion.

The new formation of capillaries begins in the sclera and in the corneal limbus with the acute inflammatory conjunctival vascular reaction. When a slight corneal necrosis occurs, the vascular invasion progresses. The vessels appear on the cornea and invade almost all its surface from the limbus toward the center. The trunks pass from the limbus and there divide at right angles into numerous branches that form a loop plexus in the corneal margin, gradually extending toward the center.

The speed of return to the normal of the

ocular structures varies according to the intensity of the pathologic alterations. The corneal transparency is soon restored, but the blood vessels persist longer.

The eyes of several animals (rabbit, guinea pig, rat, mouse) show a similar picture, but pigeons show marked resistance to the ocular action of the several drugs. This apparent resistance may be related to the abundant watery conjunctival secretion which dilutes and washes out the drug.

It is not clear what relation the "exogenous" irritative vascularization of the cornea bears to the similar vascularization of the cornea which develops in animals with malnutrition from a diet deficient in vitamin A, riboflavin, or in aminoacids (histidine, phenylalanine, tryptophane, lysine, threonine, leucine, isoleucine methionine and so forth). The "endogenous" vascularization is an index of the nutritional conditions and regresses with return to normal diet and adequate respiratory enzymes.

Summary and Conclusions

The irritant local effects on the ocular membranes are studied by direct application of the drugs into the conjunctival sac of one eye of the rabbit; the other eye is treated with normal saline solution and used as a control.

The drugs tested, in several concentrations, were the following: Anthraquinone, arsenic trioxide, chrysarobin, colchicine, emetine, histamine, paraphenylenediamine, podophyllin, quinone, menadione, and resorcinol.

The clinical manifestations produced by different concentrations of these drugs are detailed and a classification in groups in order of potency and concentration is given.

The relation of solubility, physical state, concentration, time of contact, and frequency of application of the drugs and its irritant effect is discussed, as are the immediate, acute, and delayed inflammatory changes, and the opacity of the cornea and its vascularization.

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SOME ASPECTS OF STUDYING BINOCULAR VISION*

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It is the custom in modern medicine to classify disease processes on an etiologic basis and to direct treatment toward elimination of the causal condition. In disturbances of binocular vision a specific etiologic diagnosis is desirable, but it rarely suffices as a basis for therapy. History and physical examination must be directed toward determining the etiology, but in addition the status of the various complex components of binocular vision such as retinal correspondence and degree of simultaneous perception must be established before therapy can be outlined. These components may vary in diverse ways independently of the etiology.

The system of studying binocular vision in patients at The University of Oregon Medical School is based upon the concept that these anomalies are fundamentally deficiencies rather than positive phenomena. With few exceptions, patients with defective binocular coördination are lacking in one or more of the physiologic components of normal single binocular vision. Therefore, a systematic investigation of each of these physiologic components to determine if it is deficient or adequate provides a practical approach to the clinical study of binocular anomalies. A rigid routine of tests is not followed; rather, the physiologic components are investigated by the technique most applicable to the case.

The components of comfortable single binocular vision are interrelated, but, as a basis for examination, they may be divided into four sensory and four motor groups (fig. 1).

* From the Department of Ophthalmology, The University of Oregon Medical School. Aided by a grant given by Dr. and Mrs. John E. Weeks in memory of Dr. Frank R. Mount. Read before the sixth annual meeting of the American Association of Orthoptic Technicians, Chicago, Illinois, October 12, 1947.

SENSORY COMPONENTS

As a first step in examination of a given case, monocular tests are made to determine if vision in each eye is useful for binocular coördination. A full field of vision and normal visual acuity are not necessary, but, for orthoptic training, a patient must usually have at least 25 or 30 degrees of overlapping visual field in each eye and one eye must be capable of central fixation. Since the development in recent years of methods of peripheral fusion training,[1] acuity of 20/50 or better in each eye has not been essential for

PHYSIOLOGIC COMPONENTS OF BINOCULAR VISION

I - SENSORY

1. Useful vision and similar images in each eye.
2. Simultaneous binocular perception.
3. Normal retinal correspondence.
4. Cerebral integration of binocular perception (Fusion).

II - MOTOR

5. Full rotations and concomitant versions
6. Approximate parallelism of lines of distant fixation in fusion free position.
7. Ample fusional movements.
8. Accomodation - vergence balance.

Fig. 1 (Swan). Physiologic components of binocular vision.

binocular training. Every effort is made to restore vision in an amblyopic eye, but children with a persistent amblyopia of 20/100 or 20/200 in a squinting eye are no longer denied the benefits of orthoptics.

SIMILAR IMAGES IN EACH EYE

For maintenance of comfortable single binocular vision, the retinal images in the two eyes must be similar. It has not been possible to make routine studies for aniseikonia in patients with defective binocular vision, but otherwise every effort is made to detect inequality in vision of the two eyes. Accurate refraction is an essential part of every examination. Great care is taken to detect and correct oblique astigma-

tism and anisometropia, as well as hypermetropia and myopia. Textbooks emphasize the relationship of hypermetropia to esotropia and myopia to exotropia, because uncorrected, these refractive errors disturb the accommodation—vergence balance. This emphasis is justified but the high incidence of anisometropia, oblique astigmatism, and unilateral astigmatism in the common tropias of childhood is indicative that dissimilar retinal images are also of etiologic importance in binocular incoördination. A review of 1,000 cases of esotropia in children revealed this type of refractive error to be approximately four times as frequent as in children with normal binocular vision. The converse is also true. Disturbances of binocular vision seem almost invariable in the presence of uncorrected anisometropia of any appreciable degree. In addition to refraction, patients are carefully studied for any organic pathologic conditions which might produce an inequality in vision in the two eyes.

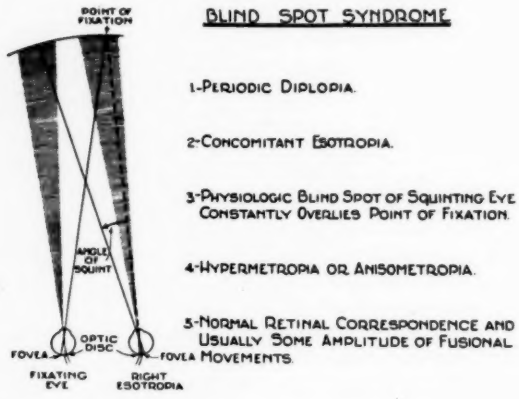

Fig. 2 (Swan). Blindspot syndrome.

Simultaneous binocular perception

Simultaneous binocular perception is a second physiologic component of single binocular vision. Study of this faculty is of the greatest importance in all anomalies of binocular vision, but it seems commonly neglected or considered as a qualitative faculty. The degree of simultaneous perception varies greatly with the circumstances under which the eyes are used, that is with the type of the retinal stimulus and the particular retinal areas which are stimulated. For example, there are few patients with useful vision in each eye in whom some degree of binocular perception cannot be demonstrated under ideal circumstances, namely, by use of vertical prisms, a red glass, a totally dark room, and a bright point of light for fixation. Many patients may also demonstrate binocular perception on haploscopic devices, but otherwise may have some degree of suppression. It is essential, therefore, to study simultaneous perception as a quantitative phenomenon.

Establishment of good binocular coördination by training is futile if the patient has a useful degree of binocular perception only on haploscopic devices; therefore, it is particularly important to determine the degree of binocular perception which exists under ordinary visual conditions. A satisfactory method is to study the field of binocular vision on a large screen in a fully illuminated room with a filter-twin projection system. Either red and green color filters of the type described by Lancaster,[2] or of polaroid may be used with two projectors to separate the objects perceived by the two eyes. Normally it should be possible to demonstrate retinal rivalry and the absence of suppression scotomas in the central field of vision. If a suppression scotoma is found, it is important not only to plot its size, but also to determine its intensity by variations in the size and brilliance of the targets.

In esotropia, it is particularly important to determine the position of the physiologic blindspot because the normal blindspot is frequently a part of suppression scotomas. In some instances the blindspot may be utilized as a central scotoma by the squinting eye.[3] Recognition of this "blindspot syndrome" is important because it is common (fig. 2). If treatment is properly directed, the prognosis is favorable.

Bifoveal fixation under ordinary visual circumstances represents the highest degree of simultaneous binocular perception. It is not essential for comfortable single binocular vision, but its presence or absence is of clinical importance. For example, the demonstration of bifoveal fixation in a corrected case of unilateral esotropia has seemed the best indication that good visual acuity will persist in a formerly amblyopic eye. For studying bifoveal fixation, polaroid filters and twin projectors are used in a lighted room with the aluminized screen at least three meters from the patient. While the patient maintains perifoveal fusion, the central one degree of binocular field of vision is studied for scotomas with targets subtending small visual angles.

Normal retinal correspondence

Correspondence between the functions and the anatomy of the retinas and visual pathways of the two eyes is one of the essential components for normal single binocular vision, but is often lacking in the common tropias developing early in childhood. Study of retinal correspondence is, therefore, an essential part of the routine of examination in disturbances of binocular vision. Varied techniques must be used because the state of retinal correspondence may change with the circumstances of testing, particularly in cases receiving treatment. One test may indicate normal, while another test demonstrates anomalous correspondence, or the same test may yield inconsistencies. This is not an indication that one or the other test is erroneous; rather it provides the examiner with an indication of the stability of the correspondence and the circumstances under which it varies.

It is our custom to study the state of retinal correspondence at the same time that the field of binocular vision is plotted with a filter-twin projection system because anomalous retinal correspondence invariably is associated with some degree of suppression.[4] Haploscopic tests of retinal correspondence are made with a major amblyoscope. The after-image test is also used in most cases. Demonstration that the two foveal regions have the same visual direction is considered evidence of normal correspondence.

Cerebral integration

The term fusion is often used synonymously with single binocular vision. In a strict sense, fusion is the subconscious

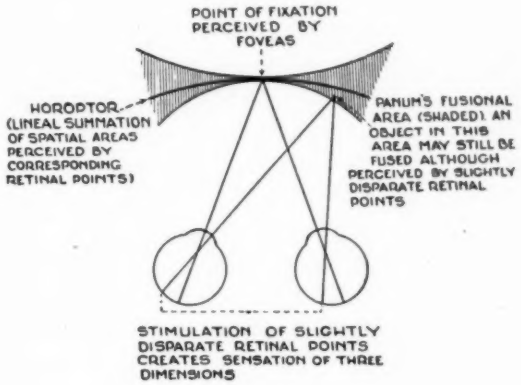

Fig. 3 (Swan). Horopter.

cerebral integration of simultaneous perceptions of the two eyes into a single conscious impression. It is commonly assumed that patients either have or do not have this faculty, but our experience indicates that it is quantitative. Normally it is possible mentally to integrate into a single impression retinal images of three dimensional objects, despite the fact that some parts of these objects must necessarily be visualized by slightly disparate retinal areas. Normal stereoscopic vision is dependent upon this ability to fuse images slightly dissimilar in the horizontal meridians, as is the normal ability to overcome the aniseikonia induced by asymmetric convergence.

Some of our patients have demonstrated a lower grade of fusional ability. Tested on haploscopic devices the only targets that these patients seem able to fuse are those identical in size and shape, such as two simple discs; that is, corresponding parts of

the two targets have to be visualized by exactly corresponding retinal points. It seems evident that in these patients the horopter lacks the depth which is called Panum's fusional area (fig. 3). Depth of this fusional area may be determined by studying the patient's ability to fuse objects of different dimensions in the various meridians.

Patients who lack the normal ability to overcome an artificially induced aniseikonia may be divided into two clinical groups. These cases will be described and discussed in detail in a subsequent report,[5] but may be summarized here. In the first group the disparate parts of the target seem selectively suppressed when aniseikonia is induced, but fusion of nondisparate areas is maintained. These patients are able to fuse stereoscopic targets but the sensation of depth is lacking. Three patients with this apparent selective suppression of disparate images have been observed over a period of five years. These individuals had comfortable single binocular vision, but failed tests for stereopsis. These patients must not be confused with the many corrected cases of esotropia who lack stereopsis because only peripheral fusion exists. In the latter the defect is associated with a nonselective suppression of the central field of vision of the nondominant eye.

In the second group of four cases, suppression of slightly disparate retinal images did not occur and annoying diplopia resulted. Initially these patients had had an alternating type of esotropia with anomalous retinal correspondence. In each case the deviation was corrected surgically. Also, intensive and prolonged orthoptic training was required before normal correspondence was established and an appreciable amplitude of fusional movements obtained. Then true fusion could be demonstrated only with simple two dimensional targets. These patients were unable to fuse targets with any degree of disparity, such as the standard targets for testing stereopsis. They could superimpose the images, but would describe either retinal rivalry or a constant sliding of the targets over each other. In an ordinary room they would describe three dimensional objects as not completely separating into two images but shimmering constantly.

When they were placed in a dark room and allowed to perceive a single, simple, two dimensional object, such as a flat illuminated picture on the wall, the shimmering would disappear and the picture would appear single and sharply defined. In 2 of the 4 patients suppression developed within six months after termination of orthoptic training. It was not possible to follow one case for more than three months, but in the fourth case the patient was still diplopic after two years. Experiences with the above cases have led us to study the fusional faculty as a quantitative phenomena. An ability to overcome induced aniseikonia is investigated in every case of long-standing alternating esotropia. Lack of this ability and the absence of suppression seem a possible explanation for one type of so called "horrors fusionis."

Motor components

Full rotations

The motor phase of the investigation is usually initiated with studies of the ocular rotations. Good rotations are essential components of comfortable, single binocular vision. In our examination, duction (monocular rotation) tests are not neglected, but in detection of spastic and paralytic phenomena greater emphasis is placed on the concomitance of binocular rotations in the cardinal fields of gaze. These tests are conducted in the usual manner, but in the search for those slight degrees of nonconcomitance which may occur with a muscle paresis, the Lancaster red-green test used at a distance of 5 or 6 meters seems more accurate, as well as simpler, than the commonly used diplopia fields plotted with red glass and point light. Ophthalmographic studies provide a highly objective and sensitive means of studying concomitance for near fixation. Twin tele-

scopes are used to pick up and focus the corneal reflexes on a calibrated ground-glass plate for direct study or on moving film for permanent recording.

Parallelism of lines

For comfortable, single binocular vision, deviation of the eyes in the fusion-free position must not be greater than that which can be readily overcome by a reasonable amplitude of fusional movements; that is, approximate parallelism of the line of distant fixation of the two eyes is another component of normal binocular vision. To study this component the deviations are measured in the cardinal fields and in the primary position by the usual techniques, but under varying circumstances. Where possible, objective tests such as the cover and corneal reflex are supplemented by the usually more precise subjective procedures such as measuring the separation of the images by a filter-projection system or devices such as the Maddox rod.

Amplitude of fusional movements

Another component of comfortable binocular vision is amplitude of fusional movements adequate to overcome easily any deviation of the eyes in the fusion-free position and to permit the maintenance of binocular vision when fixation is shifted from a near to a distant object and vice versa. Both associating and dissociating types of fusional movements are studied under varying circumstances and by diverse techniques. The amplitude of fusional movements is affected by fatigue and other circumstances; therefore, conclusions as to the amplitude of fusional movements are never made from a single examination. Normally, complex and detailed stereoscopic targets may stimulate fusional movements, but in a patient with defective binocular vision they are apt to be confusing and lead to suppression or retinal rivalry. In our experience simple two dimensional targets are most suitable for indicating a patient's potentialities in regard to fusional movements. In all cases it is important to measure the range of convergence and divergence from the fusion-free position of the eyes as well as in relation to orthophoria; that is, to measure the absolute convergence and divergence.

Vergences are coördinated fusional movements which must not be confused with the uncontrolled ductions of the nonfixating eye that may occur when fusion is disrupted. Comparison of fusion-free deviations for near and distant fixation is of value but does not indicate the state of the accommodation vergence relationship. To diagnose an insufficiency or excess of divergence or convergence on this basis alone is not physiologically sound. For example, uncontrolled adduction of the nonfixating eye occurs with accommodation in the so-called accommodative types of squint. Before hypermetropia is corrected and binocular vision is established, such patients are often mistakenly diagnosed as having a convergence excess because the inward deviation of the eyes is much greater for near than for distant fixation. A true convergence excess does not exist, as is demonstrated when the refractive error is corrected and single binocular vision is reëstablished. Then a marked deficiency of convergence almost invariably exists.

Accommodation-vergence balance

A final physiologic component of single binocular vision is a good balance between accommodation and the horizontal vergences. Accurate study of balance between accommodation and vergences is not possible until after the patient is able to maintain fusion and has acquired some amplitude of fusional movements. Then the amplitudes of divergence and convergence are determined in relation to a fixed amount of accommodation and the amplitude of accommodation is measured in relation to a fixed degree of convergence. Fine fixation targets are used over measured periods to detect accommodative spasm or fatigue.

Management of individual cases

Knowledge of phenomena other than those described above is vital to the management of individual cases. For this reason the ophthalmologist must not restrict himself by adhering to a fixed routine of tests or techniques. The system of studying binocular vision described above is a comparison of the individual patient's binocular status with the normal by the technique most applicable to his case. The system of investigation frequently elicits phenomena which necessitate special study. For example, if paresis or paralysis of an extraocular muscle is demonstrated, an examination must be made for secondary phenomena such as contracture of the direct antagonist or overaction of the yoke muscle in certain fields of gaze. Also in such cases determination of the usually fixating eye has great importance. Finally, it should be stressed that the study of binocular vision is only one part of a complete ophthalmic history and examination. Disturbances of binocular vision frequently result from organic disease of the eyes. This is particularly true in young children because any disturbance of vision is almost certain to alter binocular development.

Interpretation of data

In interpretation of data obtained from any type of examination, it must be kept in mind that the status of the various components of binocular vision varies with the circumstances under which the eyes are tested. This is particularly true if binocular vision is defective; therefore, the study of the same binocular phenomena should be made by the ophthalmologist and the orthoptic technician using different techniques and working under varying circumstances. In this respect we commonly observe two extremes. At one extreme is the ophthalmologist who thinks of orthoptics only in terms of therapy and therefore neglects to use orthoptic facilities in his diagnoses. He is prone to send patients to the orthoptic technician without a specific diagnosis or purpose. The results are certain to be poor. At the other extreme is the busy ophthalmologist who, when orthoptic facilities and a skilled technician are available, neglects his own simple tests such as are made with prisms. He may feel that the phenomena of binocular vision can be more accurately and extensively investigated by the technician utilizing equipment such as the major amblyoscope.

Determine usual status of functions

The major amblyoscope is excellent for determination of the patient's binocular potentialities because circumstances can be created which are nearly ideal for single binocular vision. Considerable deviation can be overcome without distortion of the targets, the patient's field of vision can be limited to a few degrees, and the technician may stimulate retinal areas of her choice. The intensity and the character of the stimulus can be altered by changing the color, illumination, size, shape, and background of the target. Even the duration of the stimulus can be accurately controlled. Nevertheless, the conditions of this type of examination are artificial and strikingly different from those in which we ordinarily use our eyes. Therefore, it seems best to rely more upon other types of tests to determine the usual status of the patient's binocular functions.

Study of binocular function in an illuminated room containing three dimensional objects and maintaining the patient's full field of vision is essential if normal conditions are to be simulated. In this respect filter-twin projection devices fill an important place, as a supplement to prisms, the screen test and similar office procedures. With two projectors which can be directed in accordance with the deviation of the patient's eyes, and with the use of polaroid or color filters to separate the objects perceived by the two eyes, it is possible to duplicate many of the binocular visual tests which

must otherwise be performed on haploscopic devices. It is possible to stimulate retinal areas of the operator's choice and at the same time to maintain a full peripheral field of vision. In determining the status of binocular vision for near fixation, emphasis is placed upon bar-reading tests and ophthalmographic studies made while the patient is actually reading or writing.

After data obtained by examination is interpreted, the deficiencies of the case are summarized and binocular potentialities are discussed by the ophthalmologist and orthoptic technician before treatment is planned. It seems essential that responsibilities for treatment be delegated specifically. Orthoptic training is not given unless its purpose is agreed upon by the ophthalmologist and orthoptic technician. It is important that, during the course of treatment, the patient's condition be reviewed by both at frequent intervals.

Criteria for functional cure

No system of studying anomalies of binocular vision is complete unless the criteria for a functional cure are established. Dependence must not be solely upon tests made under the artificial circumstances which haploscopic devices provide. Most disappointing are those patients, who, after intensive treatment, demonstrate parallelism and a high degree of binocular vision upon the stereoscope, but who, under the ordinary circumstances of using their eyes, lack even simultaneous binocular perception. We designate these patients as "stereoscopic cures" because they have good single binocular vision only under ideal circumstances which such haploscopic devices provide. Anomalies of binocular vision cannot be considered fully corrected until the presence of comfortable single binocular vision is demonstrated under circumstances in which the patient normally uses his eyes.

Summary

In cases with defective binocular vision, it is desirable to make an etiologic diagnosis; but to plan treatment and evaluate therapy the status of the various components of binocular vision must be determined. Ananolies of binocular vision seem fundamentally deficiencies in which the patient is lacking in one or more of the physiologic components of single binocular vision. These are interrelated, but for purposes of examination they can be divided into four motor and four sensory groups. Systematic investigation of these physiologic components provides a convenient and flexible routine for clinical study of patients with anomalies of binocular vision. Components such as simultaneous binocular perception and the faculty of fusion are quantitative phenomena, and must be studied accordingly.

It is important to study the field of binocular vision, and to determine the size and intensity of suppression scotomas. In esotropia, the normal blindspot is frequently utilized as a central scotoma. Localization of the normal blindspot of the squinting eye is, therefore, essential to recognize the "blindspot" syndrome. Absence of Panum's fusional area is discussed as a possible explanation of one type of horrors fusionis.

When binocular vision is defective, the status of such phenomena as simultaneous binocular perception and retinal correspondence varies with the circumstances under which the tests are conducted; consequently, it is important for the ophthalmologist and the orthoptic technician working coöperatively to study the various binocular phenomena separately and by varied techniques. In general, haploscopic devices on which it is possible to create nearly ideal circumstances for binocular vision are most suitable to determine the potentialities of a given case, but study under ordinary visual conditions is essential to determine the usual status of binocular function. In this respect filter-twin projection systems seem of particular value.

In diagnosis and treatment of binocular anomalies there is no need for complex

classifications. A summary of a patient's deficiencies and analysis of his binocular potentialities serve as a basis for therapy. In evaluation of treatment, it is stressed that a patient may have parallelism of his eyes and demonstrate a high degree of single binocular vision under the ideal circumstances which haploscopic devices provide, but cannot be considered normal until the presence of comfortable single binocular vision is demonstrated under the conditions in which the patient customarily uses his eyes.

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Discussion of Dr. Swan's paper

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I think that everyone who has just heard Dr. Swan's paper must now be looking forward to its publication and the opportunity of reading and studying it. It covers so much that is vital to orthoptics that once over is not enough.

In analyzing the sensory and motor components necessary to maintain single binocular vision, Dr. Swan has worked out a logical and concise classification. Nevertheless, it forms the basis for a more thorough examination of squinters than is customarily made, with emphasis on quantitative determinations whenever specific data can be obtained. This is, perhaps, best exemplified in his studies of simultaneous binocular perception in which he makes accurate plottings of the fields of binocular vision and of suppression scotomas.

In this connection, I would like to ask Dr. Swan on how young a patient he can obtain these data. I have felt quite triumphant when, once or twice, I have been able to map the blindspots of a five-year-old child. On the other hand, it is possible to determine the status of retinal correspondence and to start fusion training with most four-year-old children and some who are three years of age. If Dr. Swan can plot the binocular fields and suppression scotomas of these little patients, then I think that he must be "Superman!"

Although techniques have not been worked out, as Dr. Swan indicates, for making quantitative routine studies of aniseikonia in patients with defective binocular vision, one occasionally gets an indication of its presence in squinters during the course of carrying on orthoptic treatments with a major amblyoscope. In such cases, the spontaneous report is given that the target before one eye is larger than that before the other; specifically, "the lion is too big for the cage," or with the second-grade targets "the bunny with the flower is bigger than the bunny with the tail."

There are no more important tests for binocular function than those for retinal correspondence, as evidenced by the fact that at least 50 percent of all squinters develop an abnormal retinal correspondence, and that any unsupervised orthoptic training in its presence will serve to confirm rather than correct the squint. It is sometimes dif-

ncult for those who have not made the various tests to appreciate how variable retinal correspondence can be. However, the orthoptic technician is inclined to rely primarily on the results obtained with a major amblyoscope, since the training directed toward correcting an abnormal correspondence is carried on under the same conditions as those under which the test is made.

The two grades of fusion observed by Dr. Swan are comparable, it seems to me, to the second and third grades of binocular vision described by Worth, namely simple fusion and stereopsis.

In my experience, some simple fusion can be elicited in most squinters under ideal instrument conditions during the course of orthoptic treatments, but a fairly large percentage of these patients never learn to interpret the disparity of stereopsis targets in terms of depth, even though they may have attained binocular vision for casual seeing. I do not know whether, in daily life, these patients have better binocular than monocular perception of depth. Is this not another example where the instrument situation should be compared with that of ordinary function?

During tests made this past year, I found only one individual who was acutely aware of a diplopia of the disparate elements of stereopsis targets. She was a young adult, having had surgery some years ago, and was complaining of a diplopia of recent development. At the time, I considered the orthoptic prognosis good, but Dr. Swan's results with similar cases seem to indicate otherwise.

In the manuscript which Dr. Swan sent me, he called attention only to the fact that many cases of so-called convergence excess reveal a marked deficiency of convergence "when their hyperopia is corrected and single binocular vision is established." I am pleased to learn from his remarks tonight that he has noted, as I have, that this deficiency of convergence is demonstrable even earlier, during the course of routine examinations with a major amblyoscope.

It is not necessary to discuss in detail the battery of tests for ocular motility, muscle balance, and fusion amplitudes which complete Dr. Swan's exhaustive study of binocular functions. The advantages of a variety of tests and of repeated tests need no further elucidation. His warning against relying wholly on results of preliminary tests and final evaluations obtained with instruments cannot be too strongly underscored. A divergence excess may simulate an esophoria on the major amblyoscope and an apparent cure simulate a functional one.

The transfer of training from the instrument situation to that of daily life presents one of the major problems of orthoptics. Many patients develop a pattern or set for the particular exercise situation and any binocular ability which they attain is active only during training periods. How to effect the conversion of these specialized visual skills to the routine binocular habits of daily seeing presents a constant challenge to the orthoptic technician. Those patients, designated by Dr. Swan as "stereoscopic cures," who do not achieve this final step are in reality orthoptic failures.

Dr. Swan emphasizes that the final goal of orthoptics is "comfortable binocular vision under circumstances of normal seeing." In spite of the admitted orthoptic failures, he implies throughout his paper that this final goal can be achieved by a sufficient number of patients with binocular disturbances to make orthoptic training worthwhile. Were this not so, then such comprehensive studies of binocular functions as he carries on would have little practical value and they would belong in the field of academic research.

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FURTHER EXPERIENCES WITH INTEGRATED EYES AND VITALLIUM IMPLANTS*

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Since Ruedemann's[1] epoch-making report on his work on artificial-eye implants for use in enucleation, much has been done by him and others to improve on technical details. Most of the work has been done with the idea of developing a permanent implant with which can be integrated a removable eye.

The idea behind the development of Vitallium implants was to provide: (1) An implant to which the muscles and fascia of the eye may be permanently attached at the time of enucleation. (2) A similar implant that may be used in evisceration. (3) A similar implant which may be used for the late replacement of buried implants.

A series of implants were made of Vitallium in which cracks and crevices could not develop, and each was provided with an exposed, standard, flat anterior face in which there was a uniform oval depression for the reception of an integrating peg on the posterior surface of the artificial eye.

Vitallium was selected because of its extensive use in surgery and dentistry for many years and its ability to be cast in permanent form in the shape of a hollow sphere. Each implant is made in permanent form so there can be no shrinking of plastic parts away from metal parts or cracks developing due to the aging process, as in the case of plastic. There can be no question of allergy or other reaction to a plastic, and the removable eye is later fitted to the implant.

The advantage of replaceability is obvious when one considers that scratches may develop and changes in color (no permanent dyes have yet been found) may take place over a period of years. The position of the eye can be changed at will by simply relocating the peg on the back of the eye without any surgical procedure. Also, any enophthalmos or exophthalmos can easily be corrected by altering the thickness of the artificial eye.

Vitallium is a metal of low electropotential in the body and has, therefore, very little tissue reaction, as shown by the studies of Venable and Stock.[2, 3]

A preliminary report on the use of these implants in enucleation and evisceration has already been given.[4] This paper will primarily be concerned with changes in technique and shape that have been made from the original form.

A. CHANGES IN FORM OF IMPLANTS

1. ENUCLEATION

The entire implant is now polished and the depression on the anterior surface is made with steeper sides so that the integrating peg can be more accurately fitted and the eye and the implant more completely integrated (fig. 1B).

Changes in technique. It is found that when silk sutures are used, much less discharge is present than when cotton or linen is used.† The discharge lessens gradually over a period of 1 to 4 months and is reduced to a minimum by the occasional use (once or twice weekly) of sulfacetimide (15-percent drops) and sulfathiazole ointment placed in the depression on the face of the implant.

2. EVISCERATION IMPLANT

This implant is inserted through the usual corneal opening enlarged by two radial incisions. Two additional incisions are made posteriorly in the sclera from within, one above and one below to receive the anchor bars.

* Presented at the 83rd annual meeting of the American Ophthalmological Society, Hot Springs, Virginia, June, 1947.

† Absorbable plain gut sutures (3-0) are now used.

The bars are then easily pulled through the openings by four double-armed 3-0 plain gut sutures. They are first threaded around the bars and then passed through each end of the scleral openings and brought out through the conjunctiva in each fornix, and tied in the conjunctival fornices. When these sutures are tied, the bars are forcibly held through the sclera. A small transparent plastic cup 12 mm. in diameter, with two slits corresponding to the position of the bars, aids in locating these scleral openings properly.

The sclera is then wrapped around the neck of the implant and covered over with conjunctiva. The sclera contracts around the body of the implant and the anchor bars remain outside of the sclera. This gives a firmly anchored implant of perfect motility. It is made in two sizes, regular 18-mm. (fig. 1C) and a smaller size with a 12-mm. body to be used in case of a shrunken eye (fig. 1D).

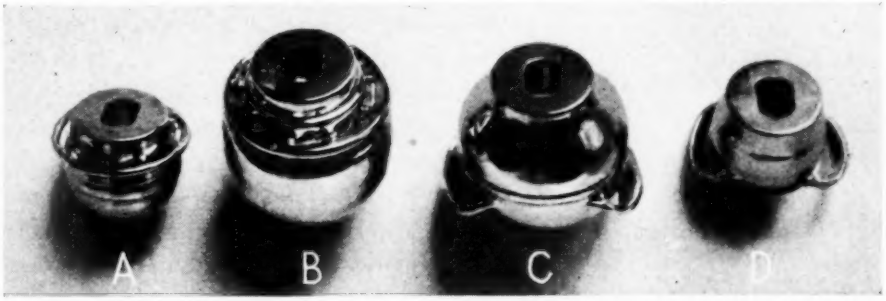

Fig. 1 (Hughes). New design of metal implants all with the same depression on the anterior face for the reception of the integrating peg on the artificial eye. (A) Smaller sized implant for use in replacing buried implants. (B) The depression on the anterior surface of this enucleation implant is made with steeper sides so that the integrating peg can be more accurately fitted. (C) Regular 18-mm. evisceration implant. (D) Smaller sized evisceration implant with a 12-mm. body.

3. Replacement implant

This is a smaller sized implant for use in replacing buried implants, somewhat similar in design to the enucleation implant and has been used since the preliminary report was given (fig. 1A).

This implant is made 12 mm. in diameter at its equator but the anterior face and depression are kept standard so that the same peg can be used on the back of the eye as on the other implants.

The ring for the muscle and fascial attachments is necessarily smaller than the ring on the standard enucleation implant and only four supports are used to provide more space for the tissues to pass around the bar.

Change in surgical technique

Operative procedure

The conjunctiva of the back of the socket is separated from the underlying tissues by ballooning it up with a very superficial injection of procaine hydrochloride or saline (fig. 2A). A strip of tissue about 4-mm. wide is dissected up anterior to and in line with each of the recti tendons to increase the effective length of the tendon (fig. 2B) so there will be enough tissue to pass around the attachment bar without tension.

A suture is placed in one side of the end of each tendon and tied in place. The tendons are individually passed forward between the bar and the body of the implant, and then folded over the bar and attached back to themselves (fig. 2C). Another suture is placed in the other side of each of the tendon strips to spread them out. Tenon's capsule is brought up on each side of each muscle tendon and folded back over the bar in a manner similar to the muscle tendon

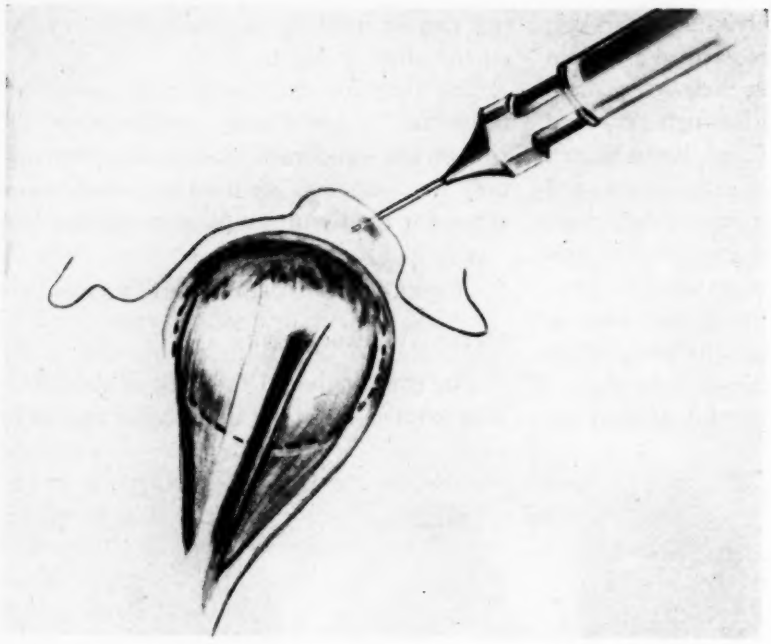

Fig. 2A (Hughes). Ballooning up conjunctiva overlying muscles and sclera.

strips (fig. 2D). Each portion is then sewed back to itself.

The conjunctiva is then anchored around the face of the implant (fig. 2E), and the surgical form is fitted to retain the fornices and to steady the implant in proper position during the early healing process (fig. 2F).

This surgical form is made of clear plastic in order to be able to see that the peg on its posterior surface is actually fitted into the depression on the anterior surface of the implant. It also has two holes drilled obliquely in the anterior convex face for the reception of a Lester forceps to aid in its manipulation or removal and replacement. It is oval and can be obtained in various sizes. The standard one is 22 mm. by 29 mm.

A moderate pressure dressing is applied,

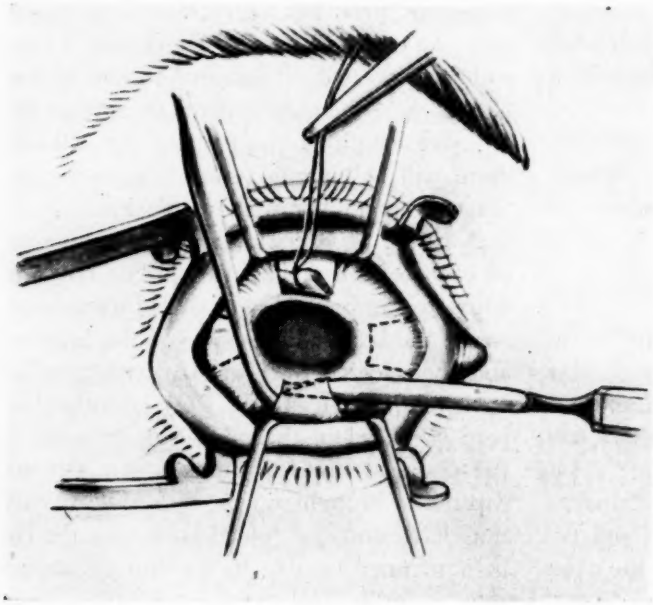

Fig. 2B (Hughes). Dissection of muscles, each with a scleral tip (same as for enucleation).

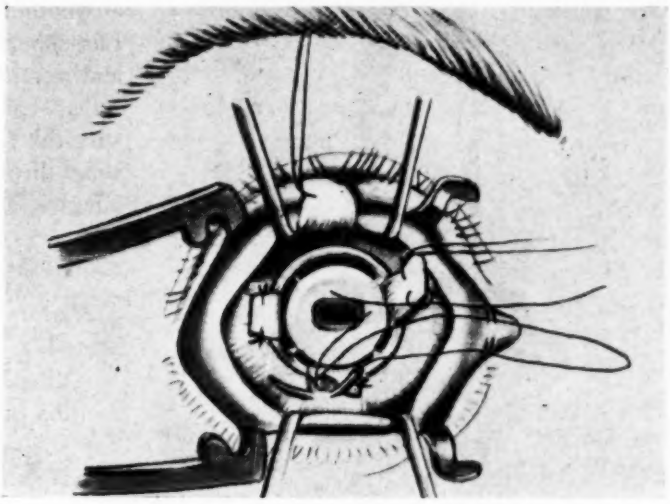

Fig. 2C (Hughes). Each muscle strip is passed forward around bar and attached back onto itself passing around the bar.

and a mask with a hole, 2-cm. across, in front of the good eye is used to limit its rotation for the first two weeks. In this way there is less strain put on the muscles during the early healing process.

The tissues may be inspected through this form at the dressings and, if the condition appears satisfactory, it may not need to be removed for 2 or 3 weeks. At the end of three weeks, an artificial eye may be fitted.

Integrating of the eye with the implant

An ordinary stock plastic eye is selected first for color, size, and general fit. Then the position of the peg in relation to the corneal position is determined. A trial eye with a peg located centrally can be placed in position to see if the eye is properly located in relation to the other one. If it is divergent, the peg must be placed more temporally than on the final eye. If it is slightly

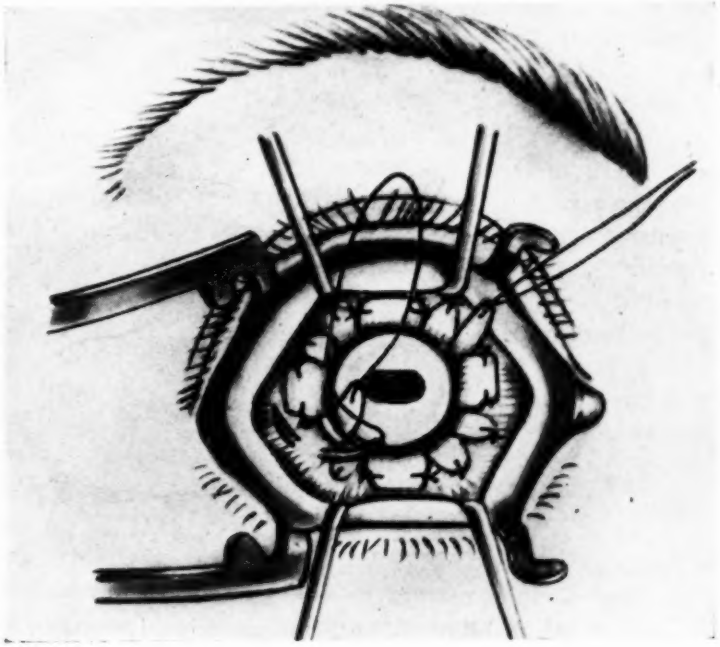

Fig. 2D (Hughes). A scleral strip on each side of each muscle is likewise passed around the bar and attached back to itself.

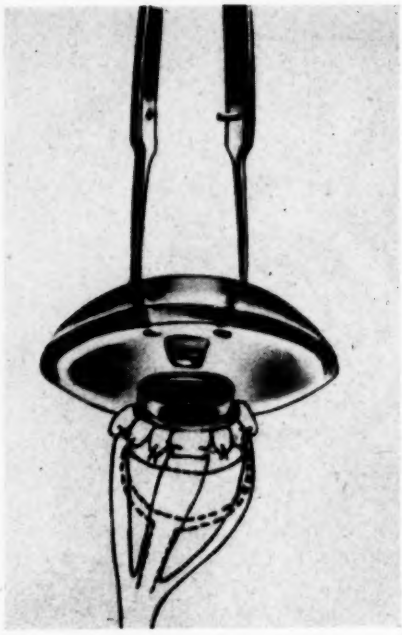

Fig. 2E (Hughes). Body of implant fits into scleral cup formed by posterior half of sclera.

convergent, the peg must be moved nasally to bring the cornea into line with that of the other eye. If it is too high or too low, a similar adjustment can be made to give the eye the correct position.

Another method would be to use the Hirschberg reflex from the normal cornea and compare its position with the similar reflex from the front of the transparent surgical form to locate the position of the reflex in relation to the peg on the posterior surface.

Case Reports

Case 1

History. Mr. A. W., aged 67 years, presented a case of evisceration in which a Vitallium implant had been inserted four months previously. He was operated on the day following its extrusion for the insertion of a Vitallium replacement implant (12-mm. body).

Technique. The conjunctiva was ballooned up and dissected free from the underlying muscles and fascial tissues. The muscle tendons were isolated and a strip of tissue, 3-mm. wide, anterior to the tendon, was dissected up with each tendon. A suture was put in one side of the end of this strip and the first part of a surgeon's knot was tied. Each of the muscle tendons was isolated from the globe and the anterior portion of the sclera removed. The posterior one half

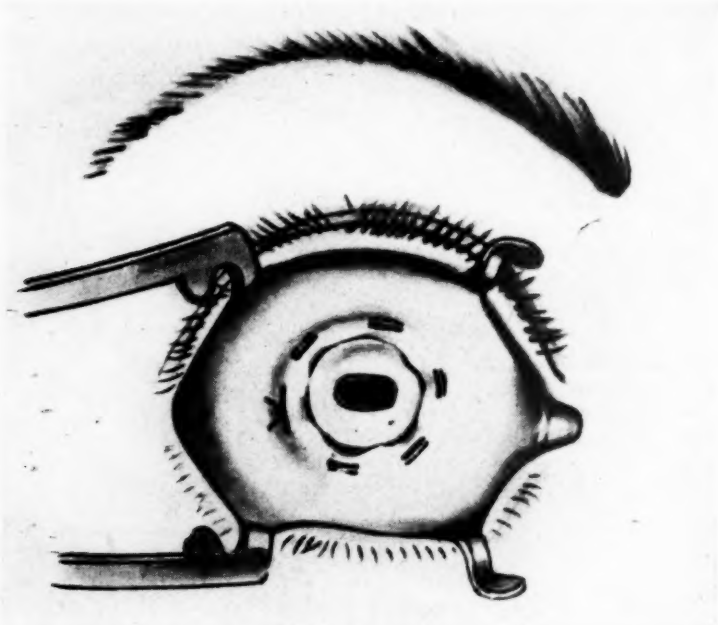

Fig. 2F (Hughes). Conjunctiva is anchored around the open face of the implant.

of the sclera was not disturbed and was retained and served as a cup for the reception of the body of the implant. The muscle tendons were attached to the ring as illustrated and the fascial strips brought forward on each side of the muscle strips and sewed back on themselves as has been described.

The regular sized enucleation implant (17 mm.) was tried first to see if it would fit. It was found that there was not sufficient room to admit the body of the implant.

The integrated eye has now been fitted, with excellent movement and a normal upper lid.

CASE 2

Evisceration with insertion of a new model Vitallium implant with anchor bars. Mr. W. B. complained of pain in an eye that had been blind for several years. A band keratitis was present with calcareous degeneration and breaks in the epithelial covering. There was considerable staining of the cornea with fluorescein. A corneal curettage was done and, due to chronic irritation, it was decided to do an evisceration two months after the patient was originally seen. The eye was widely divergent (about a 30-degree arc).

Technique. The procedure already described under evisceration was used except that the incisions were made under the lateral and medial recti for the purpose of doing the evisceration and placing the implant. Also a resection of about 6 mm. was done on the medial rectus to help straighten the eye.

Healing was uneventful but there was still a divergence of about 20 degrees. The surgical form was exchanged for an artificial integrated eye at the end of three weeks, with excellent motility except for slight limitation in the nasal field. The condition of the upper lid was normal.

In this case the implant was made with the anchor bars opposite the long axis of the oval depression on the anterior surface of the implant for comparison with the result when the bars were placed in the vertical meridian. No conclusion on this problem can be reached until a larger series of cases has been done.

CASE 3

History. A boy, aged 16 years, had his left eye injured by an explosion of a .22 bullet. Enucleation with insertion of 18-mm. implant was done. This boy insisted on playing baseball one week after his operation and would not coöperate. Two weeks after his operation, he tripped and fell and suddenly felt something "give way." The attachment bar was found to be exposed temporally and he was returned to the operating room where the lateral rectus and adjoining fascia were dissected up and reattached to the bar, and the conjunctiva was closed again.

He has now been fitted with an artificial eye but there must still be some question about the final outcome even though the present condition is satisfactory.

CASE 4

History. Miss V. Y. has worn an artificial eye for many years following an enucleation for a severe injury to the eye. There was very limited motility in all directions and some sinking in of the upper lid.

The muscle cone was dissected down its center by sharp, followed by blunt, dissection, with surprising ease. The tissue strips in the region of the recti muscles were dissected and looped around the attachment ring and sewed in position. The conjunctiva was anchored around the open face of the implant and the surgical form inserted (fig. 3).

The integrated eye was fitted in three weeks with excellent cosmetic results both static and dynamic.

CASE 5

History. Mr. D. F. aged 40 years, had an enucleation without implant 28 years ago. The patient had been kicked by a horse and

the left eye was removed one year later. No ball was put in at the time. There was poor motility of the artificial eye. A procedure similar to that in Case 4 was done. Three weeks later the integrated artificial eye was fitted with excellent appearance and motility.

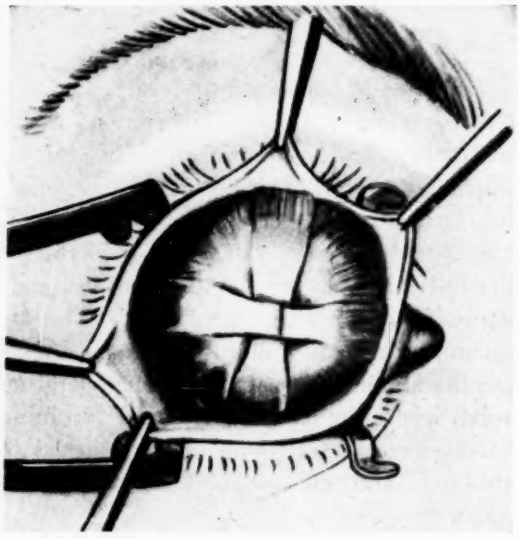

Fig. 3 (Hughes). Plan of operation in cases where enucleation was done previously with or without a buried implant.

Conclusion

It is too early to draw definite conclusions, and it will be 10 years or more before final results can be truly evaluated, but from preliminary results, it is evident that a definite improvement in the appearance, especially of the upper lid, and of the motility of an artificial eye is possible.

These implants, made in a hollow-sphere construction of Vitallium, noncorrosive, nonelectrolytic metal in which cracks and crevices cannot develop, are thought to be superior to implants made solely of plastic or a combination of plastic and metal.

No amalgam reaction is present with mercury compounds given internally or applied externally as may occur with gold or other compounds. This is important when one considers the fact that, if mercurials are given internally, sufficient mercury is secreted through the skin to cause amalgam formation in gold spectacle frames worn over long periods. This consideration would also be of importance to persons who work with mercury, such as reported by Dr. W. S. Atkinson.[5]

The integration of the eye with the implant by means of an oval peg is designed to prevent rotation of the prosthesis. The shape of the depression is standard for all sizes and shapes of implant.

These implants provide a series of shapes and sizes for various types of procedure; namely, enucleation, evisceration (2 sizes) or replacement.

A replaceable eye is obviously an advantage over a permanently placed eye, since it can be changed if the color is not correct or if color or position change in the course of years. Its position, horizontal, vertical, and anteroposteriorly, for the correction of an enophthalmos or exophthalmos, can be easily altered without any further surgical procedure.

131 Fulton Avenue.

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3. ———: (From a brochure published by J. B. Lippincott Company, 1943).
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NOTES, CASES, INSTRUMENTS

A NOTE ON PLASTIC TEST OBJECTS FOR PERIMETRY*

LOUISE L. SLOAN, PH.D.
Baltimore, Maryland

It is generally recognized that the early detection of scotomas and other localized defects in the visual field may require the use of test objects of very low visibility. Low visibility may be obtained either by means of white test objects subtending very small visual angles, or by the substitution of colored for white test objects.

Several arguments in favor of the second of these procedures may be advanced. (1) Examination of the visual field with both red and blue test objects frequently provides information of diagnostic importance that is not given by the use of white test objects. (2) In order to obtain low visibility it may be necessary to employ 1/1000 or 1/2000 white targets; whereas, approximately the same level of visibility is provided by 1/330 or 3/1000 red and blue test objects.† Because of their greater visual angle the colored test objects of equivalent visibility are less influenced by an uncorrected error of refraction.

White test objects, on the other hand, possess many practical advantages in comparison with the colored paper discs commonly employed. Any ordinary white paper or paint may be used; whereas, in the case of the colors, standardization, not only of the reflectance, but also of the hue and the saturation of the color is necessary if tests made at different times and by different examiners are to be comparable. Frequent replacement of the colored paper discs when they become soiled or faded is essential. It is difficult to obtain a satisfactory adhesive for mounting the discs that will not change their color.

White, red, and blue test objects cut from plastic material in sheet form have been used for the past nine years at the Wilmer Institute and have proven far more satisfactory than paper test objects. The flat discs are secured to the wands by means of a special plastic cement. If the test target becomes soiled it is easily and quickly restored to its original color by wiping its surface with a damp cloth. Samples of the plastic materials, after exposure to direct sunlight for a period of several weeks, showed no perceptible change when compared with unexposed samples.

TABLE 1

COLORIMETRIC SPECIFICATION OF PLASTIC MATERIALS IN ILLUMINANT C

	Munsell Notation			Reflectance	Trichromatic Co-ordinates	
	Hue	Value	Chroma		x	y
White	4.7 PB	8.78	2.1	0.7400	0.298	0.305
Red	5.1 R	3.72	11.0	0.1026	0.534	0.312
Blue	6.2 PB	3.77	9.8	0.1053	0.202	0.179

Colorimetric specifications of the white, red, and blue plastics in artificial daylight illumination (Illuminant C) are given in Table 1. The reflectances of the red and blue samples, 0.1026 and 0.1053 respectively, are practically identical and are a close match to the reflectance of the gray arc of the Ferree-Rand perimeter. It has been

* From the Wilmer Ophthalmological Institute of The Johns Hopkins University and Hospital.

† A 1/1000 test object subtends a visual angle of 3.4 minutes; 1/2000, 1.7 minutes; 1/330, 10.4 minutes; 3/1000, 10.3 minutes.

shown that best results are obtained in color perimetry when the color is viewed against a background of approximately the same brightness.* The colors are more nearly equal in chroma than are the Heidelberg red and blue papers. Normal subjects, therefore, have fields of about the same extent for red and blue test objects of the same size. With Heidelberg colors, on the other hand, the normal field for blue is significantly wider than the field for red. Approximately equal visibility of red and blue test objects in the case of the normal eye is desirable, in order to detect a differential impairment of sensitivity to the two colors.

In summary, it is believed that the special features of these plastic test objects eliminate the major difficulties which have led to the virtual abandonment of colored test objects by many perimetrists.

Johns Hopkins Hospital (5).

B. PYOCYANEUS CORNEAL ULCER TREATED WITH PENICILLIN†

S. E. Pendexter, Jr., M.D.
New York

Corneal ulcer caused by B. pyocyaneus is a rather uncommon condition, somewhat less than a hundred cases having been described in the literature. It is also one of the most destructive corneal lesions. Before the advent of the sulfonamides, the usual end result was a total loss of vision. In 1942 and 1943, however, successful treatment of this type of ulcer with sulfapyridine and sulfadiazine was reported by several authors.[1]

Penicillin treatment of pyocyaneus ulcer has apparently been reported only once. In 1945, Juler and Young[2] had such a case in a series of ulcers treated with penicillin locally. This case, described as severe but without hypopyon, spread rapidly and showed no response to penicillin; further details of the outcome were not given.

Case report

D. C., a 9-year-old white girl, was admitted to the Manhattan Eye, Ear, and Throat Hospital on June 17, 1947. Four days prior to admission she had had a foreign body and rust ring of the left cornea removed at another hospital. During these four days, the left eye became increasingly red and painful.

Examination. When the patient was first seen at this Hospital, there was marked blepharospasm and tearing of the left eye. Conjunctival injection was severe, and in the central cornea there was a horseshoe-shaped ulcer involving perhaps a third of the cornea; the edges of the ulcer were elevated but not undermined. A small hypopyon (3 to 4-mm. wide) was present, and the iris was moderately dilated (previous mydriatic). Examination of the deeper structures was impossible; vision was light perception.

The right eye was normal. Vision was: O.D., 20/20. There was no history of previous eye disease or injury.

Treatment. On admission, a culture of the ulcer was taken. Treatment consisted of local instillations of 1-percent atropine three times daily; penicillin drops (5,000 units per cc.) every four hours, and later every two hours during the daytime; intramuscular penicillin G, 50,000 units every four hours day and night.

Culture. The admission culture, as well as a second one taken four days later, grew a gram-negative, green pigment-producing rod considered to be B. pyocyaneus.

Course. Within 48 hours after admission, considerable improvement was apparent, the hypopyon having disappeared. Because of this it was felt that continued treatment with penicillin alone was justified. By the 10th

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* Ferree, C. E., Rand, G. and Sloan, L. L.: Sensitive methods for the detection of Bjerrum and other scotomas. Arch. Ophth., 5:224-260, 1931. (See p. 229.)

† From the Manhattan Eye, Ear, and Throat Hospital.

day, there was no staining of the cornea, and on the 14th day the patient was discharged from the Hospital. At this time, there was only slight injection; a central macula was present, involving the anterior layers of the cornea and preventing a clear view of the fundus; and vision was limited to counting fingers at one foot.

After discharge, local treatment with penicillin and atropine was continued for 10 days. Three months after the onset of the present illness, the corneal macula is still present, but has shown some clearing. Vision is now 20/200, O.S.

Conclusion

A case of B. pyocyaneus corneal ulcer is presented which apparently responded to local and parenteral penicillin therapy.

210 East 64th Street (21).

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MALIGNANT MELANOMA OF THE IRIS

Jesse M. Levitt, M.D.
Brooklyn, New York

Case report

T/4 R. E. H., a white man, aged 30 years, was admitted to Fletcher General Hospital, Cambridge, Ohio, on September 4, 1944. He had been evacuated from the E.T.O. where he had been examined by several ophthalmologists, including the Consultant in the E.T.O., all of whom had diagnosed malignant melanoma of the iris of the right eye.

History. The patient related that, while stationed in Iceland, his right eye became red and painful and a tiny black pinpoint spot was noticed on the globe. He had had about six attacks of pain in the right eye, each lasting 7 to 10 days. The black spot on the globe had increased gradually to its then present size over the course of 13 months. The vision of the right eye had become slightly blurred during the same period of time. He also complained of headaches behind the right eyeball at night. There was no history of any trauma to the eye.

Examination disclosed vision to be: O.D., 20/40, J1 corrected with a −0.75D. cyl. ax. 90° to 20/20; O.S., 20/20−3, J1, corrected with a −0.25D. cyl. ax. 180° to 20/20. There was no muscle imbalance.

The right globe was white; there was a fleshy pterygium nasally encroaching 2 mm. on the cornea; a pear-shaped pupil pointing up at the 1-o'clock position and reacting actively to light except above; a blue-black crescent-shaped lesion, measuring 4 by 2 mm. and elevated about 1 mm. above the surface of the cornea, situated at the periphery of the cornea and overriding the limbus corneae extending from the 12- to the 1-o'clock positions and occupying the anterior-chamber angle.

Slitlamp examination showed numerous blood vessels coursing over the surface of the lesion. The temporal part of the lesion was translucent; the nasal periphery was faintly translucent. The iris presented numerous "freckles," rust-colored conglomerations of pigment. The media were entirely clear. The optic disc color was good. There was a small central cupping of the disc. There was an irregular whitish area with fine pigmentary changes located at

the first bifurcation of the superior temporal vein about one disc diameter from the nasal border of the disc. Tension was 18 mm. Hg (Schiøtz).

The left eye, externally, was negative in

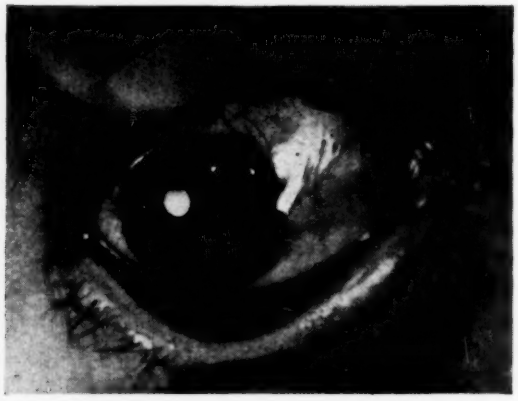

Fig. 1 (Levitt). Lesion simulating malignant melanoma of the iris.

every respect. The iris presented numerous nevi of a character similar to that noted in the right eye. The media were clear. The optic disc and fundus generally were normal. The disc was not cupped. Tension was 18 mm. Hg (Schiøtz).

X-ray films of the right globe were negative.

General physical examination yielded negative results. Blood Wassermann was negative.

Diagnosis. My diagnoses were (1) malignant melanoma of the iris of the right eye; (2) benign melanoma of iris, multiple, bilateral; (3) pterygium, right eye.

The right eye was enucleated under intravenous pentothal anesthesia on September 15, 1944. Healing was uneventful.

Microscopic report

The following is the microscopic report of Col. J. E. Ash:

Gross. The specimen consists of a firm eye measuring 24 by 24 by 23 mm. A small elevated pigmented lesion (3.5 by 2 mm.) is situated at the limbus between the 12- and 2-o'clock positions. There is hemorrhagic thickening of the limbus at the 4-o'clock position (in paraffin). The pupil is eccentric. The eye is opened between the vertical and horizontal planes. There are multiple retinal folds posteriorly. The iris adheres to the posterior surface of the cornea on one side. The optic nerve is too short for cross section.

Microscopic. Descemet's membrane is interrupted at the site of a bulging keratoiritic scar which is covered by conjunctiva and surface epithelium and is lined by atrophic iris and its pigment epithelium. On this side the filtration angle is occluded by anterior synechia. Redistributed pigment is present in the atrophic iris and the spaces of Fontana and around the canal of Schlemm. Chronic inflammatory cells are very sparsely scattered throughout the iris and there is ectropion uveae. The choroid is thin. There is cystic degeneration of the retina at the ora serrata. The lamina cribrosa appears somewhat depressed but this may be due to operative trauma. One separate paraffin section shows hemorrhagic detachment of the ciliary epithelium and another elastosis and hyalinization of the stroma of the limbal conjunctiva.

Diagnosis. Pterygium; perforation of cornea near limbus; prolapse of iris; cystoid cicatrix; low-grade iritis, with atrophy and redistribution of pigment.

991 Ocean Avenue (26).

CORNEAL SCISSORS

Walter Moehle, M.D.
Brooklyn, New York

The present trend in cataract surgery indicates the employment of a small corneal section made with a keratome or Graefe knife. This incision is enlarged for free passage of the lens, a procedure easily ac-

complished by using scissors especially designed* for the purpose.

When these scissors are visualized as lying on a flat surface, the blades are seen to curve in two planes: (1) upward from the plane of the shanks, and (2) laterally away from the line of the shanks. Both pairs are identical except that the lateral curve is to the right or to the left for use on corresponding sides of the corneal incision.

The lateral curve naturally follows the corneal rim as the tip of the lower blade, which is blunt to avoid engaging the iris stroma, enters the chamber along the plane of the iris. The curve away from the horizontal plane facilitates the handling of the scissors, especially in deep-set eyes.

The blades are the same length, being 14- to 15-mm. long. On either side of the pivot hinge, the scissors are 4- to 5-mm. wide. It is believed that this width, together with the double curve, permits strength and firmness in the blade which eliminates slippage or springing apart of the blades sometime encountered in scissors of a lighter construction. I have used these scissors for more than six years and have found them to be most satisfactory.

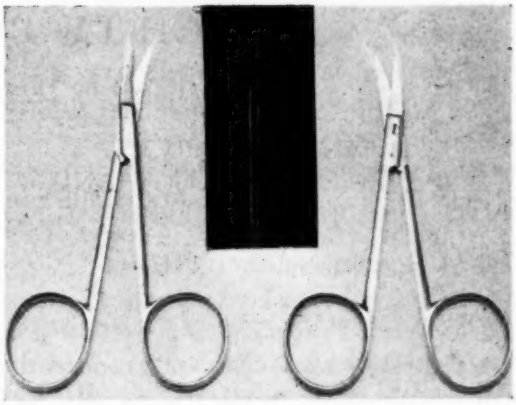

Fig. 1 (Moehle). Specially designed corneal scissors for cataract surgery.

*Manufacturer, William Langbein & Bros., Brooklyn, New York.

15 Schermerhorn Street (2).

Historical Miniature

The history of the ophthalmoscope illustrates how the solution of a problem must await the mind of genius and how easy it is to make a modification, once the master has showed the way. Kussmaul clearly understood all details of the problem, but succeeded only in building an ophthalmoscope that had a serious defect: it did not reveal the fundus. On the other hand Donders easily substituted a perforated silvered mirror for the multiple cover glasses that Helmholz had described, because he could not curb his impatience while waiting for an instrument of Helmholz's design to be delivered to him.

SOCIETY PROCEEDINGS

Edited by DONALD J. LYLE, M.D.

MEMPHIS SOCIETY OF OPHTHALMOLOGY AND OTOLARYNGOLOGY

September 9, 1947

ATOPIC CATARACTS

DR. J. WESLEY MCKINNEY reported the case of W. M. S., aged 31 years, who was seen in February, 1947. His history was that the vision had become progressively worse for the past three months. He had had chronic eczema over the face and body for many years and also was asthmatic. He had received a number of small doses of X ray. Vision was corrected to 20/40 mostly, right eye; 20/50 mostly, left eye. The eyes were entirely normal except for central anterior and posterior subcapsular lens opacities in each lens. The skin of the face, parts of the body, and extremities was leathery, scaly, and slightly reddened. This is the stage of lichenification of chronic eczema. The association of cataract with chronic eczema in a young person is rare, only 40 cases having been reported in the literature up until 1940. It is supposed that the lens, being an ectodermal structure, may take part in this allergic disease of the skin with the formation of cataract. Linear cataract extraction was performed on the left eye in April, 1947. The resulting vision was 20/20, J1.

PAPILLEDEMA OF UNKNOWN ETIOLOGY

DR. J. WESLEY MCKINNEY reported the case of Miss A. McC., aged 17 years, who was first seen December 31, 1940. For most of her life she had been subject to attacks of semicoma which was considered to be petitmal epilepsy. The attacks lasted for only a few moments as a rule and she was otherwise a normal healthy girl. Because of the finding of choked discs she had been subjected to a complete neurologic study including the spinal fluid and air injection. All examinations were negative. The ocular examination revealed vision to be 6/6, J1 in each eye. There was a quarter diopter of hyperopic astigmatism in each eye. The pupils were equal and active. The ocular movements were normal. The ophthalmoscopic examination revealed two diopters of papilledema of both discs. The vessels on the discs showed sheathing. The retinal veins were slightly dilated. Fields showed general contraction and enlargement of the blindspots. The patient, now 23 years of age, was last seen in March, 1946. She had been checked at intervals for six years without change in the fundus picture. The fields have varied from full to marked general contraction. No other symptoms have developed.

LOCALIZED EDEMA OF THE RETINA

DR. J. WESLEY MCKINNEY reported the case of Mrs. R. G., aged 43 years, who was first seen for this affection on September 7, 1945. She complained of a central area of dim vision which had been present for seven days. Vision was: O.D. 6/6; O.S., 6/24, improved to 6/9 partly with +1.5D. sph. There was edema of the retina of about 1½ disc diameters in the area immediately below and involving the macula. There were no hemorrhages or exudates, and the blood vessels of the region of the lesion seemed normal. There was a paracentral scotoma, the lower margin of which just missed the macula. The peripheral field was normal. Physical examination was completely negative. It was thought that this might be a case of Gifford's central angiospastic retinopathy. However, no evidence of vasospastic disease could be made out. The edema and paracentral scotoma persisted for a month and gradually subsided. Five months later the retinal edema was entirely gone leaving behind a few fine yellow spots. A small rela-

tive paracentral scotoma persisted. The refraction which had been +1.5D. sph. was now +0.25D. sph.

Recurrent retrobulbar neuritis, chiasmal arachnoiditis

Dr. R. O. Rychener reported a case of recurrent retrobulbar neuritis apparently due to multiple sclerosis. E. C., aged 18 years, was admitted to the Memphis Eye, Ear, Nose, and Throat Hospital on February 26, 1942, because of acute failure of vision of the right eye during the previous week. There was no light perception in his right eye, the pupil measured 4 mm. and reacted to light, consensual reflex being present. The visual acuity of the left eye was normal. No intraocular pathologic condition was apparent, and the diagnosis of retrobulbar neuritis was made. Treatment with foreign protein and vasodilators over a period of two weeks caused improvement of vision to counting fingers at two feet and, in the course of the next three months, the visual acuity of 6/7.5, J4 was obtained. The right nerve was definitely pale.

On June 11, 1943, the patient awoke with blurring vision in the left eye and reported after three days with vision diminished to moving objects. Hospitalization and the same treatment were given with visual improvement of the left eye to 6/18 after six months. At this time there was definite pallor of both optic discs.

On November 3, 1944, visual acuity was 6/7.5, J1 and 6/9, J1, as recorded. Ten days later visual diminution in the right eye was again noticed, vision being recorded at 6/24, foreign-protien therapy was again instituted with visual recovery in two weeks to 6/10, J3.

On October 30, 1946, acute visual failure was again evidenced in the left eye, visual acuity being 1/40 which, under treatment, improved only to 2/60, J12.

During these episodes complete general and neurologic examinations were made with entirely negative results.

In April, 1947, he was seen in consultation by Dr. W. L. Benedict at the Mayo Clinic where the findings above were confirmed but all examinations proved to be negative with regard to etiology. At this time the visual fields were concentrically reduced two thirds in the right eye and one half in the left eye.

On August 12, 1947, he submitted to chiasmal exploration by Dr. J. C. Love at the Mayo Clinic who reported the visual apparatus at the chiasm completely surrounded by dense proliferative arachnoiditis with a collection of fluid causing distinct pressure on the nerves and chiasm. The fluid was evacuated, the proliferating arachnoid was resected, thus thoroughly decompressing the nerves, chiasm, and tracts. On August 28, Dr. Henry Wagener thought there was some slight improvement in visual acuity and visual fields.

The patient apparently made a satisfactory convalescence from this intracranial surgery but on October 26, 1947, suddenly developed paraplegia and retention of urine and was brought to the Baptist Hospital for care by Dr. Semmes and Dr. Murphey. The patient suddenly died on the 10th day following the development of these symptoms, and the diagnosis was not established since no postmortem examination was allowed. In the light of the previous history of recurrent attacks of retrobulbar neuritis and the concluding syndrome it was thought that this patient had multiple sclerosis.

Pseudotumor of orbit

Dr. Charles M. King reported a case of inflammatory pseudotumor of the orbit in a white man, aged 27 years.

Mr. K. R. was first seen on July 31, 1947, with history that for the past six weeks the right eye had been uncomfortable, red at times, and the vision was blurred. Discomfort was not severe enough to prevent his teaching school. No history of recent injury could be obtained. There was a history of sinusitis several years ago while

he was in the armed forces in Europe, but only supportive treatment was necessary.

Examination showed the right eye to be slightly red, but no secretion was present. The palpebral conjunctiva was normal. There was a manifest hypertropia of 10$^{\Delta}$ to 15$^{\Delta}$ but the patient was not aware of diplopia until tests elicited it. The pupil was round and reacted well to light. Movement of the eye was limited down and out and diplopia was greatest in this field, although it was present on looking directly out, and up and out. There was slight exophthalmos, measuring O.D., 18 mm., O.S., 16 mm. (Hertel).

Fundus examination revealed the media to be clear. Above the macula, and also below, and including the temporal aspect of the disc margin, the retina appeared wrinkled and somewhat elevated. Marked tortuosity of the vessels was present. The A-V ratio was about normal. There was a small indistinct grayish area temporal to and below the macula. The left fundus was normal.

Vision was: O.D., 20/40, corrected to 20/20; O.S., 20/20.

The patient was not seen again until August 30, 1947. There had been less pain in the eye although there was constant diplopia. Medial rotation of the eye was possible but movements in all other directions were markedly reduced or absent. The fundus picture was about the same. Corrected vision was still 20/20. Visual fields showed approximately normal perimetric form for a one-degree white target. X-ray examination on this date failed to reveal any definite mass or change in the orbit.

On September 15, 1947, the patient was next seen. Meanwhile he had been seen by a local ophthalmologist as well as by an ophthalmologist and an otolarygologist in another city. A diagnostic irrigation of the right antrum was done elsewhere and no evidence of infection in the antrum was found. At this time the patient was not able to move the eye out or downward. Hypertropia 15$^{\Delta}$ to 20$^{\Delta}$ was still present. A firm mass could be palpated over the outer half of the lower orbital rim extending from the region of the external canthus to the midline and backward along the floor of the orbit. The lower lid was firmly bound to this mass; the lower fornix being almost obliterated. Only slight tenderness was elicited on forceful palpation of the mass.

On September 25, 1947, an orbitotomy was done by transconjunctival approach over the tumor itself. Densely matted fibrous and vascular tissue filled the lower half of the orbit binding the external rectus and the inferior rectus within its substance. These muscles were dissected with much difficulty and isolated. The inferior oblique was exposed from its origin to its insertion and resembled a piece of firm, resistant spaghetti. On severing this from its attachment to the globe a clear fluid was seen to flow out spontaneously. The entire muscle was excised. Biopsy of other regions in the mass was done, it being impossible to remove the whole thing from the orbital floor.

The pathologic report was chronic inflammatory tissue, fibrosis, focal necrosis, and degeneration of striated muscle. No evidence of malignancy was found. Blood Kahn was negative on two separate tests. A mild leukocytosis was the only other positive laboratory finding.

Convalescence was uneventful and the patient left the hospital on the third day. On October 21, 1947, the right eye was almost straight, there being about 5$^{\Delta}$ hypertropia. Good levator action was present and there was no exophthalmos. There was no diplopia, because visual acuity had decreased to 10/200, correctible to 20/70. Tortuosity of the retinal vessels was still marked, but the posterior pole area had no apparent edematous areas. The patient was comfortable and has continued his work.

Orbital tumor

Dr. Charles M. King reported a case of orbital tumor in a white girl, aged three years, which proved to be a lymphocytic

nodule in an acute state of lymphatic leukemia.

C. A. W., an apparently healthy child, was first seen on September 4, 1947. The mother stated there had been a puffiness of the lower lid for two months and recently she had felt a hard lump in the lid. No history of serious illness of any nature could be obtained.

Examination revealed a definite, hard, smooth mass, palpable through the left lower eyelid along the lower orbital rim and extending from the midline to the outer canthus. No displacement of the globe was present. No limitation of motion of the globe was found. There was no evidence of external inflammatory changes. The mass was movable from below upward and slightly movable from side to side. Transillumination of the mass was clear. Over the left mastoid region were three distinct nodular masses about the size of a pea, none of which was tender to palpation. There was one similar nodule over the right mastoid region, and palpable nodes along the posterior cervical chain on either side were present.

On September 8, 1947, a skin incision was made along the temporal two thirds of the lower orbital rim and a well-encapsulated smooth, fibrous tumor, measuring approximately 3½ by 2½ by 1 cm. was removed from within the lower aspect of the orbit. None of the extraocular muscles was involved. There was little difficulty in removing the entire mass intact by blunt dissection. The fascia was closed with interrupted catgut sutures and the skin closed with a subcuticular suture of black silk.

Laboratory findings:

Date	RBC	WBC	Hb
9-5-47	4,130,000	5,580	12.4 mg.%
9-13-47	3,550,000	4,300	10.5 mg.%

Concentrated smear showed 100% lymphocytes.

Preoperative X-ray examination showed a destructive process involving the floor of the orbit and roof of the left antrum. However, at operation these bony changes were not evident by palpation of the lower orbital rim or floor of the orbit.

Pathologic diagnosis was lymphatic leukemia and the lesion in the orbit was interpreted as a leukemic infiltration of the subcutaneous tissue.

The immediate postoperative course, in so far as the orbit was concerned, was uneventful. However, the typical symptoms of acute leukemia became more marked clinically. The daily temperature showed spiking and fluctuated from 100°F. to 104°F. (rectal reading). On the 12th hospital day the parents wished to take the child home. At last reports the patient was still alive but was incoherent part of the time and unable to be out of bed.

This case of acute lymphatic leukemia is of interest to us in that the first clinical evidence of the disease was manifest in the orbit and serves to impress upon us the many possibilities in diagnosing tumors of the orbit.

Optic neuritis treated with histamine

Dr. Philip Meriwether Lewis reported a severe bilateral optic neuritis, which responded rapidly to treatment with histamine.

C. M., a white man, aged 27 years, was first seen on February 2, 1947, because of marked visual failure. Two weeks previously he began to have severe headaches and lost the vision of his right eye. Ten days later the vision began to fail in the left eye. He was told that his trouble was due to sinus disease and, without benefit of X-ray studies or consultation with a rhinologist, was treated daily for the supposed infection of his sinuses. When first seen, vision was reduced to light perception in the right eye and 20/50 in the left. This had fallen by the next morning to counting fingers at four feet. The pupil of the right eye did not react to light and that of the left eye only sluggishly. The discs were both moderately swollen and red to almost the same degree. The retinal vessels were engorged but there

were no hemorrhages. The visual field of the left eye was mostly lost below and temporally. General physical examination and blood studies were negative. Dr. Sam Sanders found the sinuses normal and suggested using histamine intravenously after the method of Horton. This was done—2.75 mg. in 300 cc. of normal saline, intravenously, daily for a total of six times. In addition typhoid-H antigen was administered. Improvement was rapid and he was dismissed from the hospital on the 12th day with vision of O.D., 20/50; O.S., 20/40. The edema had subsided.

Two weeks later vision had improved to O.D., 20/40; O.S., 20/30. Both nerves appeared normal, but the right blindspot was still twice the normal size. He had resumed work and noticed only a very slight headache occasionally. Observation every 6 or 8 weeks was advised.

Comment. It was felt that this was a case of early multiple sclerosis and that while the neuritis would probably have subsided eventually without treatment, the use of histamine intravenously was beneficial in hastening recovery.

Monocular hysterical blindness

Dr. Philip Meriwether Lewis reported two cases of hysterical blindness of one eye.

Case 1. A white man, aged 38 years, who was in charge of the public schools of a nearby community, was first seen in March, 1944, because of nervousness which he attributed to his eyes. Examination showed his eyes to be normal except for a slight hyperopic astigmatism (+0.50D. cyl. ax. 90°, O.U.). His vision was 20/20, J1 in each eye. His accommodation was rather low, being only four diopters. Glasses were prescribed for reading.

The patient was next seen in August, 1946. He stated that his right eye had become sore and red the previous day and that it had lost its vision. He had been having some recent headaches and said he was quite nervous. Examination showed some congestion of the conjunctiva with slight chemosis. The pupil was normal in size and reaction. The fundus was normal. Vision was no light perception. In the left eye, it was 20/20. The right eye was tender to pressure and painful on motion. The visual field and blindspot of the left eye were normal. A diagnosis of an acute retrobulbar neuritis was made and he was hospitalized for study and treatment.

Complete physical, neurologic, laboratory, and X-ray examinations were made and found negative. Treatment consisted of dionine and hot compresses, locally; nitroscleran, intravenously; foreign-protein injections, and even penicillin. After two weeks, the patient was sent home. The only improvement was that the eye had lost its redness, edema, and soreness. He still could not perceive even a bright light.

His vision was unimproved when seen a week later. When seen again about three weeks after leaving the hospital, he still claimed inability to see light with his right eye. More than five weeks had elapsed since the blindness began, but the fundus was still normal. For the first time hysteria or malingering was suspected. With a strong fogging lens over his left eye, he read 20/50 with his right eye; and with a stereoscope, he could see the right image as well as the left. He was then told that he would positively recover his vision and probably normal vision. From that time on improvement was steady and by late October (10 weeks after onset) his vision was 20/20, J1 in both eyes with correcting glasses.

Case 2. A healthy white girl, aged 18 years, was seen in November, 1946. She claimed that four days previously she had lost the sight of her right eye. Since then she had been totally blind in that eye and had had a severe headache constantly.

Examination was completely negative. The central vision, visual field, and blindspot of the left eye were normal. By retinoscopy both eyes were found to have

practically no refractive error (+0.50D. sph.). She professed inability to see any light with her right eye. With a strong plus lens over her left eye she read 20/40 with her alleged blind eye. Careful questioning failed to elicit the cause of this hysteria or malingering, whichever it really was. Her family was told that her trouble was of nervous origin and she was referred to her family physician. After several weeks of pseudoblindness, which eventually proved to be due to dislike for her work, she recovered completely.

Comment. The first patient was a well educated and intelligent man. He had been studying very hard for an M.A. degree in addition to being overworked with his occupation. He was not satisfied unless he made the highest marks in his studies. It was felt that the probable cause of his hysterical amaurosis was that he was afraid that he would be unable to maintain the high standard which was expected of him. He therefore subconsciously used the blindness of one eye as an escape mechanism. His recovery was more rapid than usual. Most hysterical blindness is bilateral and may last for years. The second case may have been more malingering than hysteria. It is often difficult to differentiate hysterical from simulated blindness.

Daniel F. Fisher,
Recorder for Eye Section.

CHICAGO OPHTHALMOLOGICAL SOCIETY

Dr. Beulah Cushman, *president*
October 6, 1947

The clinical meeting was conducted by the Department of Ophthalmology, Northwestern University Medical School.

Scientific Program

SURGERY FOR CORRECTION OF MUSCLE ANOMALY

Dr. Watson Gailey (Bloomington, Illinois), presented this subject. An abstract of his paper follows.

Great advances have been made in recent years in muscle surgery, a branch of surgery not too difficult for the average ophthalmic surgeon. However, it is not corrective surgery we should worry about. Rather it is the proper evaluation of a given case and the thorough study of the under- or overaction of the various muscles involved which should be carefully considered before any definite surgical campaign is adopted.

These preoperative studies should engage our full attention. Following this the surgical treatment should be comparatively simple. Every case is a case in itself and some require repeated examinations. Particular study should be given to fixation and the findings in screen cover tests in all fields.

I am sure that we all know that the correction or near correction of squints of all types would be simple if we could determine *accurately* in millimeters the amount of resection or recession necessary to effect the cure of a given amount of deviation measured in diopters.

For some years in our clinic we have attempted to establish a standard of surgical procedure on which we can rely—based on our cover-test findings and translated into millimeters of recession and resection—with only a reasonable degree of success. By the cover test we painstakingly work out the lateral and vertical deviations in diopters. We estimate the degree of paresis as best we can in certain muscles, the degree of secondary contraction in the paretic muscle's antagonist, and how much the vertical component might increase the lateral deviation and record these findings on our chart. After this, we decide which muscles are to be exposed and how much recession and how much shortening these muscles must undergo. But we reserve the right to change our minds and either decrease or increase the amount of shortening or recession.

To put it simply, outline a definite procedure but do not hew to the line. Reserve

for yourself the right to change your mind and your method of attack and become more conservative or more radical as your good judgment directs.

There are certain rules which we have found to be useful in our clinic:

1. In monocular squints with amblyopia of the squinting eye we confine our surgery to the amblyopic eye if possible.

2. If the power of convergence is unlimited, there should be no fear in doing a reasonable amount of recession. If the P.C.B. is 100 or more, for instance, it is much safer to strengthen the laterals only.

3. Vertical deviations should always be searched for diligently.

4. We have concluded that: it is smart to expose the opposing muscles involved in convergent or divergent squint of any type before deciding definitely how much strengthening or weakening to do on either.

5. It is a great problem to decide how much to correct in convergent squints—partially or wholly accommodative—for great danger lies in obtaining orthophoria for distance and near without correction of the refractive error only to find that this beautiful result is converted into a very unwelcome divergence when the correcting lenses are worn.

6. A slight overcorrection is worse than 10 to 15 degrees of undercorrection and these cases must be approached with great caution. We always attempt to under correct partially accommodative squints.

7. When the P.C.B. is 90 mm. or over in convergent squints, external rectus resection is indicated. Operate verticals first if the hyper defect is greater than the laterals.

8. Visual acuity should be made equal if possible before surgery, not necessarily normal.

9. With equal paresis of superior recti of moderate degree and equal upshoot of contralateral inferior obliques, recede both obliques. But, watch your step if both superior recti are markedly paretic for you may, by recession of both inferior obliques, destroy elevation and find your patient tilting his head backward.

10. If there is a moderate paresis of both superior recti and there is 10 or 15 degrees' difference in the hypertropia, recess the oblique showing the greater secondary deviation and later you may resect or shorten the superior rectus of the same eye.

11. If there is an under correction of hypertropia after recession of an overshooting inferior oblique after three months and some increase in the hypertropia in the field of the contralateral inferior rectus muscle, this muscle must be receded.

12. When we find marked bilateral superior rectus paresis unequal, strengthen one or both superior recti, proportionately. In marked bilateral superior rectus paresis associated with esotropia or exotropia, we find these cases are liable to over correction if laterals are operated first.

13. In moderate bilateral superior rectus paresis: if fixing left in eyes right and fixing right in eyes left, correction of convergent or divergent may be all that is necessary, but, look out for P.C.B.

14. If we have an amblyopic eye with either a convergent or divergent squint accompanied by a big upshoot of the squinting eye we do a complete tenotomy or myomectomy on inferior oblique of the upshooting eye while operating the lateral.

15. In marked superior oblique paresis, a liberal recession of the secondarily contracted inferior oblique is sometimes gratifying.

16. When one superior rectus is almost completely paralyzed, resect this paretic muscle. When both superior recti are very paretic, with marked overshooting of inferior obliques, leave inferior obliques alone and resect both superior recti.

17. Inferior rectus recession. In recession of a secondarily deviated inferior oblique, as evidenced in a contralateral paretic superior rectus and a secondarily contracted inferior rectus, it is well to be cautious. We are quite satisfied to wait several months

before recessing this inferior rectus muscle as one finds frequently that the recession of the overshooting inferior oblique will tend to ease this secondary contraction in whole or part. Tensity in this muscle is greatly reduced in amount after recession of the contralateral inferior oblique and strengthening of the ipsilateral superior rectus.

18. First, strengthen the too weak muscles and weaken the too strong muscles by any effective method with which you are familiar. Although one goal of these measures is cosmetic parallelism, the most important aim for which one strives is a parallelism that permits of single binocular vision and stereopsis; in other words—a satisfactory functional result.

19. A complete chart of our findings in an individual case is on the wall of the surgery showing the full information we have gleaned concerning each case. This chart is as important as X-ray films in reduction of fractures. This bit of prophylaxis was made a must in our clinic some years ago after a muscle was recessed instead of resected. It might have been disastrous had we resected instead of recessed.

Never promise that a single operation will cure any squint. We feel safer in promising them three, when we feel that we could accomplish a cosmetic result in one. If you feel sure of your findings and confident of your conclusions and there are no contraindications to any procedure you propose to employ, there seems to be no limit to the number of muscles you may operate at one sitting providing of course you are a respector of tissue.

Discussion. Dr. Walter Stevenson approved of Dr. Gailey's treatment preliminary to operation. While muscle surgery is certainly not exact and many times does not give the desired result, any time spent in careful effort to make a proper diagnosis is well spent. It is just as important to have in the operating room a chart showing the essential findings as determined in the office, as it is to have X-ray films in certain types of surgery. One should have an open mind, as Dr. Gailey said, and at times should change the preconceived idea of what is to be done in muscle surgery.

There should be a definite understanding with the parents, before surgery is undertaken, that it may be necessary to do two, three, or even four operations. While as physicians we should be interested in the functional rather than the cosmetic result, it must be remembered that parents bring children for correction of a squint and adults come for correction of a squint because of the cosmetic defect in almost all cases. Dr. Gailey is correct in saying that if the vertical defect is greater than the lateral, the vertical should be operated on first, although he himself does not always do so. If the vertical deviation is greater than the lateral, the decision as to procedure should depend upon the amount of deviation in various fields. For example, if there were 14 degrees of right hypertropia in the primary position, which increases to the left and up, this would indicate a left superior rectus paresis and surgery should be directed to the right inferior oblique, provided there was no false ptosis of the left upper lid. In such a case, with only a small esotropia one would expect an increase after surgery, because the abducting power of the right inferior oblique would be decreased. On the other hand, an exotropia, if present, would be decreased if the right inferior oblique were weakened. Likewise, if the left superior rectus were resected, the esotropia would increase; the reverse would be true in exotropia.

As stated in the paper, everything possible should be done before surgery to correct the imbalance; a patch on the good eye is helpful. Many cases can undoubtedly be helped by orthoptic training. It should also be stated that with the use of a rotoscope, in certain instances, a vertical deviation can be markedly increased.

Dr. Stevenson was in agreement with practically all the points brought out, al-

though he felt that through a tenotomy of the inferior oblique at its insertion, one obtained more correction there than elsewhere, in addition to its being more easy to do. One should be extremely careful in operating on internal squints that are partly corrected by plus lenses, particularly if the lenses improve vision. It is very easy to convert such a squint into an external squint.

He agreed definitely with Dr. Gailey's methods of anesthesia, but did not consider shaving the eyebrow unnecessary; he also agreed that age should not be considered in correction of squint if one is sure that surgery is necessary. Plain catgut, he felt, was quite satisfactory for buried sutures.

Dr. Stevenson does not incise Tenon's capsule widely above and below the muscles, feeling too wide an incision might cause release of tension, although there must be sufficient exposure for complete observation. He emphasized the importance of dissecting the conjunctiva over the caruncle, following recession operations; if this is not done the caruncle is apt to disappear, leaving a starey eye. To remove every part of the muscle stump from the sclera may leave a depression, with sometimes discoloration.

With reference to the O'Connor cinch operation, he felt it was a clumsy looking operation and had not performed it, although all surgeons who use it are pleased with it. There has been opposition to the transplantation of a part of the superior and inferior rectus to the external rectus in abducens paralysis, but it has been satisfactory in his hands. One should be extremely careful with a hook in strabismus fixus. It is understandable that one could pull out a piece of the sclera in an effort to pull forward a muscle that under no circumstances will so pull. His results with the retraction syndrome were just as disappointing as those of Dr. Gailey.

From what has been said, one inexperienced in squint surgery might feel that convalescence in these cases is uncomplicated but a frightening experience may occur as the slides shown illustrate.

Dr. Paul V. Carelli agreed that definite diagnosis must be made before surgery is attempted. This can be done only after repeated examinations and with the screen cover test in all the cardinal fields. The amount of resection or recession to be done is learned only through experience. The late Dr. White would not commit himself by saying that so many millimeters of recession or resection would correct a certain number of diopters, merely replying to the question by saying "Do enough." Results vary with the individual surgeon; one may get a certain correction by a 3-mm. recession of the medials, while another may obtain a different correction by the same means.

In the squinting amblyopic eye, the good eye is totally occluded for about three weeks prior to surgery, and macular stimulation of the amblyopic eye is instituted. Thus it is possible to improve fixation, vision, and bring out the total deviation so that an accurate diagnosis may be made prior to surgery.

Dr. Gailey's statement that he attempts to undercorrect partly accommodative squints is probably in reference to those cases in which glasses are to be worn. In cases in which an attempt is made to remove the glasses, is an overcorrection sought?

In recession operations, he agreed that the overshooting inferior oblique must be recessed if the patient prefers the paretic eye or alternates freely. In the past six years, in a series of 250 squints, Dr. Carelli had found overacting inferior obliques in 112 patients; in 29 operated cases, recessions have been done ranging from 5 to 10 or 12 mm. with satisfactory results. He was glad to hear that Dr. Gailey has abandoned the tucking and advancement. He felt that in lateral rectus surgery more can be obtained with a bold resection than with a small resection and advancement. In recession of the medial rectus, Dr. Gailey's method of

placing sutures at upper and lower borders, 1.5 mm. from the tendon attachment to the globe instead of using the Prince forceps, is excellent. More accurate results are obtained.

In the technique of inferior oblique recession surgery, Dr. Carelli was in accord with Dr. Gailey except in one step. Recently, for fear that the scleral bite might not be placed in the proper line for proper action of the inferior oblique, he had switched to the following: After proper isolation of the muscle, a small hemostat or Kelly forceps is placed on the tendon at its insertion; sutures are then inserted at the desired point. Thus, while the muscle is still attached to the globe, it is possible to place the scleral sutures properly. The tendon is then severed from the globe and the sutures placed through the muscle. Also, Dr. Carelli agreed as to tenotomy of the inferior oblique at its insertion, because when this muscle retracts one cannot tell where it will reattach and how it will function thereafter.

Surgery in the retraction syndrome must be carefully guarded, because resection of the fibrotic exterior rectus may cause exophthalmus. Surgery in such cases should be directed toward increasing the binocular field.

Very little improvement has been reported in the procedure of joining the outer third of the superior and inferior rectus to the external rectus in paretic cases. It should be considered poor surgery if it limits depression and elevation, especially when the abduction resulting is questionable in most cases.

Dr. Gailey (closing) said that he was pleased to hear that Dr. Stevenson and Dr. Carelli agreed with him on so many points in surgical management of squints. Dr. Stevenson's report of the unfortunate complication which he so beautifuly illustrated should make us realize that postoperative complications arise even in the most skilled surgical hands. The O'Connor cinch operation might be stressed particularly in the phorias and mild tropias uncomplicated by vertical anomalies; it is not difficult, but does require practice.

What Dr. Carelli said regarding learning by experience in the amount of resection or recession in a given case is certainly true. One is bound to under- or overcorrect early in one's practice, but it is through these errors that proper judgment is acquired. Careful records of the types of muscles encountered, together with postoperative studies of the amount of correction accomplished, will be valuable.

Dr. Carelli apparently misunderstood the remarks concerning surgery employed for lateral rectus paralysis. The inner halves of the superior and inferior recti rather than the lateral halves have been used, and the results have been good.

Partially accommodative squints are always undercorrected if the hypertropia is greater than two diopters, because of the possibility that when this correction must be worn by the patient, the orthoptic state is convered into a divergence.

Dacryocystitis of infancy

Dr. J. V. Cassady (South Bend, Indiana) presented a paper on this subject which is published in full on page 773 of this Journal.

Discussion. Dr. Roy O. Riser felt that Dr. Cassady had done the society a favor tonight in provoking the question of earlier probings in congenital dacryostenosis. His results are perfect, and the lack of complications in so large a series is evidence of his skill. In performing the procedure without general anesthesia he has avoided the pulmonary complications that cause many to hesitate to do probing. Since other branches of medicine and surgery have accelerated many procedures, we also should have an open mind. The main reasons for delay have been that the patient is inarticulate; symptoms are not too alarming; and most parents

shrink from subjecting an infant to the surgical procedure.

He wished to correct the statistics quoted from his paper. Seventy-seven percent of the eyes in his own series that were treated conservatively cleared without probing. If Dr. Cassady's series of babies had been watched until six months of age, using Dr. Riser's percentages, more than 60 of the 100 cases should have cleared without probing at all. However, Dr. Cassady's procedure had prevented 3 or 4 months of blockage and stagnation of tears. One must judge for himself as to the more desirable situation, early and safe cure by probing, or a two thirds possibility of no probing by waiting. The statistical results from probing at the age of six months are equal to those done at an earlier age. His preference was for the term "dacryostenosis" for, as brought out in his thesis, a true dacryocystitis in a child is another and far more stubborn problem.

Dr. R. C. Gamble also felt indebted to Dr. Cassady for this report, to no part of which one could take exception. He has explained clearly the embryology and pathology, his series is large, his technique is very clever, and is his own. The results are perfect.

In choosing between immediate probing and massage, antiseptics and later probing if necessary, one is right either way. The situation should be explained to the parents for their decision; usually the conservative procedure is chosen. This is not meant to imply that immediate probing is radical; it is safe, simple, and effective.

A few facts should be considered in deciding the situation. The most important is that congenital obstruction of the lower end of the nasolacrimal duct very rarely, if ever, causes an acute phlegmon of the sac or the intractable infection seen in later life. These are different conditions and have a different origin. A second, less important point, is that while spontaneous recovery takes place in the majority of cases of congenital dacryostenosis, there is often moderate tearing for a few years after the pus discharge has disappeared, and there is less tearing after probing than after spontaneous recovery. A third point is that probably no ophthalmologist really knows the true percentage of spontaneous recovery; it is probably much higher than we think. Most pediatricians understand this condition quite well, and refer only the most stubborn cases to the ophthalmologist and in this they are right.

He asked Dr. Cassady whether this series of 100 cases was consecutive, or if all cases which had bony obstruction of the duct, phlegmon of the sac, fistulas, or other evidence of acquired obstruction, were eliminated. These, in his experience do not respond well to probing.

Dr. Elias Selinger agreed that early probing is indicated in most cases seen by the oculist, since these patients have already been under so-called conservative treatment by the pediatrician or general practitioner.

It is advisable to stress a few points of the technique of conservative treatment and of probing of the tear sac. The term "massage" of the tear sac is a misnomer. What one actually attempts is to employ hydrostatic pressure, that is, use the accumulated fluid in the sac and exert pressure through it in such a way that it will be forced toward the lower orifice of the tear sac and cause a rupture of the occluding membrane. For that reason, pressure should not be exerted in the upward and nasalward direction. Instead, the mother or nurse should be instructed to exert pressure nasalward and downward, beginning just below the medial canthus, as if she were trying to force the contents of the tear sac into the nose.

The need for repeated probing indicates faulty technique in most instances. Once is usually all that is necessary to establish patency. In small infants it is preferable to probe through the upper canaliculus, as in that way strictures of the more important lower canaliculus are avoided. Also, the tear sac is more easily entered if the probe has been passed through the upper canaliculus.

Introduction of the probe is greatly simplified if the upper lid is held in an inverted position. The probe must be carried along the canaliculus nasalward and slightly posteriorward, to pass behind the caruncle. When the nasal wall of the sac has been reached, the tip of the probe must maintain contact with it while the probe is being rotated into a vertical position. Withdrawal of the probe predisposes to faulty direction. Dr. Selinger has employed a No. 0 (No. ½) Bowman probe in seven premature infants with purulent tear-sac infection; the smallest of these weighed only 2 pounds 10 ounces. In this case there was a phlegmonous inflammation around the sac that failed to respond to systemic penicillin and sulfonamide therapy. Purulent secretion broke through the skin on three different occasions under this form of therapy. One probing resulted in permanent cure. In one infant the probe was passed through a fistulous tract into the tear sac and down through the nasolacrimal duct.

Dr. J. V. Cassady (closing) said, in reply to Dr. Gamble's question, that these were consecutive cases. Some of them had acute dacryocystitis with external drainage of the phlegmon and more than 50 percent had had mucopurulent secretion. No complications occurred from probing the ducts through these infected sacs.

He apologized if he had misquoted Dr. Riser. It was the total number of patients, in some of whom both sacs were infected, which gave the apparent discrepancy.

Sac massage such as described by Dr. Selinger would be of advantage were sac distension and infection to persist after the duct has been probed open and is patent, and he thanked him for his description of the procedure.

Richard C. Gamble,
Secretary.

Historical Miniature

Neither Hippocrates nor Galen used "nystagmus" to designate rapid oscillation of the eyeball. Indeed the word did not suggest rapid motion to a Greek, but on the contrary the dropping off to sleep. They called the phenomenon "hippus," little horse. The introuction of the error in the modern use of the word nystagmus to designate restless pupils may be ascribed to Mauchart who used it in a dissertation in 1742.

AMERICAN JOURNAL OF OPHTHALMOLOGY

Published Monthly by the Ophthalmic Publishing Company

THE AMERICAN OPHTHALMOLOGICAL SOCIETY MEETING

The 84th annual meeting of the American Ophthalmological Society, presided over by Dr. Henry C. Haden, was held at Hot Springs, Virginia, May 17 to 19, 1948. In attendance were 121 members and 21 guests. Twenty-three papers on various ophthalmic subjects were presented and the program was well balanced in content.

Because of the usual high quality of its program, it is always difficult to single out, at any meeting of this society, papers that are particularly outstanding.

Lyle discussed "Cataract and Tetany Produced by Parathyroid Deficiency during Pregnancy, Lactation, and Menstruation," a combination of the work reported before the last meeting.

Reese described "Herniation of the Anterior Hyaloid Membrane Following Uncomplicated Intracapsular Cataract Extraction," and pointed out that the treatment of this condition consists in the use of strong miotics (D.F.P.) alternating, if indicated, with dilatation of the pupil with neosyn-

ephrin and recumbent position of the patient.

W. P. McGuire's paper on "The Effect of Dicumarol on the Visual Fields in Glaucoma" provoked much thought and discussion. The extraordinary improvement in the fields of vision of controlled glaucomatous subjects under dicumarol treatment reported by McGuire was most startling. If supported by experience, this is indeed a noteworthy contribution to ophthalmology.

Castroviejo summarized his vast experience in transplantation of the cornea in keratoconus, and showed many beautiful colored slides of his cases. He indicated the necessity of including the entire conical area of the cornea in excision. Thus, a large graft is frequently necessary and in his capable hands the results were excellent.

Haessler and Heise's subject "Therapy for Some Ocular Inflammations Based on Immunologic Principles," was illustrated by a clever, instructive, and amusing animated motion picture. It will be useful in teaching.

Cordes presented a case of primary malignant melanoma of the optic disc and emphasized the great rarity of this finding. It occurred in a 52-year-old Negress. Calhoun in discussing Cordes's paper brought out the fact that ocular melanoma in the pure Negro has not been observed, and ventured the guess that Cordes's patient may have been of mixed blood. This was verified by Cordes.

Harrington described his studies on "The Mechanics of Intracapsular Cataract Extraction" and demonstrated the role of the vitreous as an important factor in the dislocation of the lens. Col. Henry Smith's pioneer work in this field was thus reemphasized.

Rychener reported a case of retinoblastoma occurring in a woman, aged 33 years, the fifth such case on record. Thygeson reported his recent studies on the epidemiology of epidemic keratoconjunctivitis. He and the discussors of his paper disclosed that a large number of ophthalmologists had suffered this infection during the recent widespread epidemic.

Heath's paper on "Ocular Lymphomas" summarized and classified in a lucid manner, our knowledge of this condition.

H. Gifford pointed out that retrobulbar injection of novocaine alone is efficient in reducing temporarily the intraocular pressure, and suggested among other things that this procedure would be useful in determining the base pressure in glaucomatous individuals. Scheie's studies showed that the mydriasis produced by retrobulbar injection of novocaine could only be overcome by pilocarpine until the effect of the injection had worn off.

Since many of these papers, as well as others not mentioned, will appear in forthcoming issues of the JOURNAL, it is unnecessary to go into further details. They are mentioned here only as samples of the ophthalmologic feast spread out before the members and guests of the society. As usual the discussions of the papers were often the most valuable part of the program itself.

The reception given to the new members was made particularly gracious by honoring Dr. Walter B. Lancaster who had just celebrated his 85th birthday. He was, therefore, one year old when the society was organized. This vigorous leader of American ophthalmology enchanted his audience during the scientific meeting with a discussion of some secondary subjective effects produced by prisms, delivered in his customary logical and meticulous style.

The Howe Medal was awarded to Dr. William Zentmayer of Philadelphia for his many years of faithful and distinguished service to ophthalmology. The choice of the recipient was a happy and popular one. The influence of Dr. Zentmayer as teacher, friend, counsellor, and physician has been and is of great strength.

Although the weather was unkind, it did not prevent to any appreciable extent popular indulgence in the outdoor diversions of

tennis, riding, and golf. To those less venturesome, the verandas and lobbies invited groups to sit and enjoy shop talk, a favorite and important sport of the occasion.

Bernard Samuels of New York was elected president; Parker Heath of Boston, vice-president, and Maynard C. Wheeler of New York succeeded Walter Atkinson as secretary. The latter was appointed member of the council in recognition of his many years of efficient service as secretary to the society. It was voted to hold the next annual meeting in Hot Springs, Virginia, June 2 to 4, 1949. Derrick Vail.

CORRESPONDENCE

NEW DRAINAGE OPERATION FOR GLAUCOMA

Editor,
American Journal of Ophthalmology:

The operation of iridencleisis is discussed in a paper by Dr. Oscar Lavine and Dr. Karl Langenstrass, "A New Drainage Operation for the Relief of Glaucoma" (American Journal of Ophthalmology, 31: 78-80 [Jan.] 1948), in a way which is much at variance with the experiences of many other ophthalmologists.

The authors write:

"The scleral incision tends to close immediately and tightly due to the inherent elasticity of the scleral tissue. The incision heals quickly and firmly because large areas of mesodermal surfaces are in intimate contact. The included iris tends to undergo pressure atrophy as the result of sharp compression by the scleral lips. This event renders the operation practically valueless."

With reference to this quotation, I would like to point out that the object of Holth's iridencleisis subconjunctivalis is to create an epithelium-clad drainage canal from the anterior chamber to the subconjunctival space. Holth succeeded in proving that this objective had been attained; witness his microscopic examinations of eyes which had been enucleated directly after the death of patients who had successfully undergone iridencleisis up to six years earlier. His observations were presented as early as 1913 at the Ophthalmological Congress in Heidelberg XXXIX. His later investigations were published in December, 1930, in the *Archives of Ophthalmology* and elsewhere. Here Holth showed that pigmented epithelium lined the walls of a fistula through the sclera to the subconjunctival space. He emphasized, as an important factor in the operation, that as little subconjunctival scar tissue as possible is provoked so that drainage of the aqueous humor is facilitated. For the same reason no conjunctival flap is made, but only a subconjunctival "tunnel" at the same time that the scleral incision is made. Further, as much as possible of the fistula-forming iris tissue should be retained. On this account iridectomy is not undertaken, only a meridional iridotomy with both iris flaps lying in the scleral wound.

Very many ophthalmologists must surely disagree with the authors' comments on the value of iridencleisis and the other fistula-forming glaucoma operations. With reference to iridencleisis, I would like to refer to my own work: "The Results of Iridencleisis," published in Acta ophthalmologica, **25**:3, 1947. Permit me to quote the summary of this article:

"The results of iridencleisis subconjunctivalis cum iridotomia meridionali for glaucoma simplex in 455 eyes at least one year after this operation are presented. Vision was the same or better in 83.4 percent, the field of vision in 96.8 percent. Tension was normal without myotics in 79.8 percent, and in a further 12.5 percent it was normal under pilocarpine with which normal tension could not be maintained before the operation. Thus, as far as tension was concerned, good results were achieved altogether in 92.3 percent.

"A classification of the material in various stages according to the degree of development of the disease shows that the chances of maintaining the functions of the eye un-

changed are best when the operation is carried out in an early stage of the disease.

"An observation period of one year after iridencleisis is presumed to be long enough to give a correct picture of the state of tension."

(Signed) J. C. Holst,
Oslo, Norway.

RELIEF OF EPISCLERITIS

Editor,
American Journal of Ophthalmology:

I am able to confirm the statement of Dr. Edwin M. Shepherd who obtained immediate relief of symptoms in episcleritis with instillation of histamine diphosphate (1:1,000) described in the American Journal of Ophthalmology, **30**:907-909 (July) 1947.

Personally, I advise the use of ionization, which prevents side reactions. The principal indication is represented by rheumatic, focal episcleritis. My technique is: A histamine solution (1:10,000) is applied using 1 ma. for 1 minute, anode, positive pole. The advantage of this procedure consists in applying the drug on the focus of infection alone; it may also be repeated. Chemosis is eliminated by preliminary anesthesia.

This was studied by P. Payot (Ophthalmologica, **112**:1 (July) 1946). My method was described in 1935 (Szemészet) and in my monograph on physical therapy published in 1941. (Both of these papers are published in Hungarian.)

(Signed) Stephen de Grósz,
Budapest, Hungary.

BOOK REVIEWS

LA CONCEPTION DES COUCHES-LENTILLES CORNÉENNES, ALTERNANTES MÉCANIQUEMENT ET OPTIQUEMENT. By M. Carapancea. Standard Graphica-Marvan, Bucarest.

The corneal stroma, which occupies nine-tenths of the cornea, is of even thickness as is also the endothelium, but the other corneal components are lentiform structures. The concave meniscus of the epithelium is balanced by the convex meniscus of Bowman's membrane, while Descemet's membrane is again a concave meniscus. This architecture has the physiologic function of providing resistance both to the atmospheric pressure from without and to the intraocular pressure from within. Optically however the cornea acts as a unit, the refractive surfaces being simply its anterior and posterior surfaces.

James E. Lebensohn.

THE PHYSIOPATHOLOGY OF THE EYE IN THE AVIATOR. By A. Mercier and J. Duguet. A report presented before the meeting of the Société d'Ophthalmologie de Paris, November, 1947, pp. 1-230.

This monograph on the ocular physiopathology of the aviator is a report of the authors' thorough investigation and a review of the present status of knowledge on this subject. It is not a discussion of the physical requirements of pilots nor of the ophthalmic tests routinely used by flight surgeons but is limited to a description of the effect of flying on the organs of vision and visual functions.

The first chapter is devoted to the influence of altitude on the visual organs and describes the effect of anoxemia and atmospheric depression on the retina, choroid, pupils, visual acuity, fields, stereoscopic vision, and adaptation. It also includes a discussion on the application of oxygen and on airtight cabins in airplanes.

The second chapter deals with the influence of increasing speed on the visual organs, the brutal effect of centrifugal and rectilinear forces on the human body, and the dangers of sudden changes in the direction of flight. All these facts should limit the acceleration of the airplanes below a certain standard, at least for the time being.

The actions of physical factors are the

topics of the third chapter. The intensity of the sunlight in high altitudes, the relation of the direction of the light waves to the direction of the flight, the effect of the reflected lights and their phototraumatic and photochemical action on the retina are discussed in detail. The dangers of extreme cold are described with special emphasis on corneal changes. The deformations of the soft part of the face and of the lids through the action of the wind are demonstrated in a series of pictures. The effect of vibration on the sympathetic nervous system and visual efficiency are discussed and the hazards, which originate when all those unfavorable factors act in summation, are outlined.

The fourth chapter covers the problem of vision and orientation in the air, visual illusions in flying and flight without visibility. It explains the meaning of aerial orientation and aerial equilibration and discusses the possible impairment in the function of the labyrinth and the resulting abnormal reactions and impressions. It refers to and explains the artificial horizon as a help which provides the pilot with the knowledge of the horizontal plane and the changes in direction.

The origin, clinical appearance, and treatment of injuries and burns are the subjects of chapter 5. In the next two chapters are discussed the psychoneuroses in pilots and the intoxications which might be caused in the air by such toxic agents as gas, carbon oxide, and nitrogen tetraethyl.

The protective measures are described in the eighth chapter. The effect of ultraviolet rays on the eye, the mechanical value of protective glasses, and the importance of Noviol glasses are discussed at length.

Visual problems in connection with the construction of airplanes are reported in the ninth chapter. Among many details the placement of the cockpit to allow the largest possible field, transparent surfaces and good illumination are especially important. There are 45 illustrations and a valuable bibliography of 357 references.

Alice R. Deutsch.

CAUSES OF BLINDNESS AMONG RECIPIENTS OF AID TO THE BLIND. By Ralph G. Hurlin, Sadie Saffian, and Carl E. Rice, M.D. Washington, D.C., Federal Security Agency, Social Security Administration, Bureau of Public Assistance, 1947.

The Federal Security Agency, Washington, D.C., has issued a report which presents information on more than 20,000 recipients reported on a voluntary basis by 20 state agencies. This is the first information that has been collected on the eye conditions of recipients of aid to the blind and the underlying causes of their blindness.

The volume of information included in the report is larger than that of any previous study of causes of blindness in this country in which the cause data have been taken from medical records.

The publication will have considerable interest for those concerned with the statistics of causes of blindness.

F. H. Haessler.

ABSTRACT DEPARTMENT

EDITED BY DR. F. HERBERT HAESSLER

Abstracts are classified under the divisions listed below. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

CLASSIFICATION

1. Anatomy, embryology, and comparative ophthalmology
2. General pathology, bacteriology, immunology
3. Vegetative physiology, biochemistry, pharmacology, toxicology
4. Physiologic optics, refraction, color vision
5. Diagnosis and therapy
6. Ocular motility
7. Conjunctiva, cornea, sclera
8. Uvea, sympathetic disease, aqueous
9. Glaucoma and ocular tension
10. Crystalline lens
11. Retina and vitreous
12. Optic nerve and chiasm
13. Neuro-ophthalmology
14. Eyeball, orbit, sinuses
15. Eyelids, lacrimal apparatus
16. Tumors
17. Injuries
18. Systemic disease and parasites
19. Congenital deformities, heredity
20. Hygiene, sociology, education, and history

7

CONJUNCTIVA, CORNEA, SCLERA

Palm, Erik. **A case of crystal deposits in the cornea.** Acta ophth. **25**:165-174, 1947.

A woman 46 years of age had chronic arthritis followed by ocular discomfort, lacrimation and photophobia, which increased in intensity with the joint involvement. The objective examination revealed small, irregularly shaped, opaque, uniformly scattered spots over the corneal surface, with a clear area 1 mm. in width adjacent to the limbus. On retro-illumination each spot was found to consist of a small cubic crystalline structure, situated immediately beneath the corneal epithelium, and raising it slightly. The crystals are probably identical with the globulin crystallizing from the blood plasma. The crystallization from the blood appeared to be initiated by a change in pH following the loss of carbon dioxide from the blood. The author suggests that the loss of carbon dioxide from the superficial corneal layers may have caused a shifting of the pH toward the alkaline side, which resulted in the precipitation of these crystals. Brief reference is made to the literature on corneal opacities caused by various precipitates. The author found two cases similar to his. Meesman's patient had small amorphous desposits formed by Bence-Jones protein scattered through the entire depth of the cornea and Blobner's patient had lustrous crystals in the cornea and conjunctiva, the exact nature of which was not identified. (2 illustrations.)

Ray K. Daily.

Panzardi, D., and Pasca, G. **Bacteriologic and clinical investigations concerning the action of streptomycin on conjunctivitis due to gonococci, Koch-Weeks bacilli, diplobacilli, and on epidemic keratoconjunctivitis.** Boll. d'ocul. **26**:581-589, Sept. 1947.

Four patients with gonorrheal conjunctivitis, 15 with Koch-Weeks conjunctivitis, 29 with Morax-Axenfeld conjunctivitis, and three with epidemic keratoconjunctivitis were given four to six instillations of a streptomycin solution containing 10,000 US units per cc. for one to five days. In all cases of conjunctivitis, a complete cure was achieved within one to three days; no effect was seen in the cases of epidemic keratoconjunctivitis. In the conjunctival diseases, however, the

drug proved definitely superior to all the known ocular antiseptic solutions.

K. W. Ascher.

Ry Andersen, S. **Malignant melanoma of the conjunctiva with metastasis to the choroid.** Acta ophth. **25**:311-319, 1947.

The left eye of a woman, 35 years of age, was enucleated with the diagnosis of limbal naevus in a state of malignant proliferation. Histologic examination showed a small flat tumor in the choroid, extending backward from the equator. The limbus growth had existed for five years and the choroidal nodule was considered metastatic. The author suggests that the nomenclature of melanocarcinoma or melanosarcoma be abandoned in favor of the term malignant melanoma, which is used in the Anglo-American literature.

Louis Daily, Jr.

Verrey F. **Acute keratoglobus.** Ophthalmologica **114**:284-288, Oct.-Nov., 1947.

"If the term keratoglobus did not exist, it would have to be invented to describe the corneal malformation" which existed in both eyes of a girl, 21 years of age. Her corneas measured from 13 to 13.5 mm. at their base, were perfectly clear, about one-third as thick as normal, of conical shape in the periphery and strongly and astigmatically curved in the center. With spherocylindrical lenses the vision of the right eye was improved to 20/200, that of the left eye to 20/40. The condition was probably related to keratoconus, since in the left eye several acute phases of inbibition of aqueous (the equivalent of acute keratoconus) could be observed.

P. C. Kronfeld.

8

UVEA, SYMPATHETIC DISEASE, AQUEOUS

Bardram, M. T. **A case of iridocyclitis leprosa.** Acta ophth. **25**:265-269, 1947.

A man, 41 years of age, had lived for 15 years in the East. Eight years after the initial skin lesion on the left upper arm he developed a bilateral iridocyclitis with increased tension and lepromata on the left iris. After eight months of unsuccessful therapy his visual acuity was 3/26 in the right eye, and 2/60 in the left.

Louis Daily, Jr.

Björk, Ake. **Antistreptolysintitration in acute iritides.** Acta ophth. **25**:127-138, 1947.

Björk applied the method of titer determination to study the relation between acute iritis and rheumatic disease. The material of his study consisted of 52 cases of acute iritis of undetermined etiology, in adults, of which 22 had had previous attacks. The tabulated data of their antistreptolysin titer show an increased titer in 10 percent, which corresponds to the findings reported in a normal population. He concludes that hemolytic streptococci do not have a significant part in the etiology of acute iritis, and doubts that there is a close relation between iritis and rheumatic disease. (1 table, references.)

Ray K. Daily.

Dubois-Poulsen, and Dubois-Verlière. **Cutaneous tuberculous allergy in iridocyclitis.** Ann. d'ocul. **181**:65-81, Feb., 1948.

Following the technique of Canetti, the authors employ four intracutaneous injections in the arm at one sitting. These contain 1/10 cc. of tuberculin (obtained from the Pasteur Institute) which is diluted to 10^{-3}, 10^{-4}, 10^{-5}, 10^{-6}. The allergic reaction is considered strong, medium, weak, or absent depending on the minimal reaction beginning with the highest number. Thirty-five women and 20 men with iridocyclitis of different etiology were thus examined. Of the entire group, 71 percent showed a strongly positive reaction. In 15 patients with definitely non-tuberculous lesions the reaction was strongly positive in 45 percent and in

13 cases presumably tuberculous, the percentage was 85. In 10 cases of unknown origin, the reaction was strongly positive in 60 percent. In patients with uveal, dermal, ganglionic and osseous tuberculosis the reaction is usually strongly positive. Patients with pulmonary tuberculosis react less strongly, and the intensity of the reaction decreases with age. A strongly positive reaction alone is not sufficient to establish the tuberculous origin of a uveitis. Chas. A. Bahn.

Loewenstein, A., Foster, J., and Sledge, S. K. **A further case of iridoschisis.** Brit. J. Ophth. **32**:129-134, March, 1948.

The ninth case of iridoschisis to be reported occurred in a 46-year-old man, who had received a severe blow which broke his nose. Aside from a "black eye" on the right side, there was no apparent eye injury. Ten weeks later he noted that the color of the right iris was changing from its normal hazel to a dark blue. The vision in each eye was correctible to 6/6. The affected iris presented large brown patches of atrophy. Many of the fibers of the anterior layer had separated at the pupillary end and were hanging suspended in the aqueous or were attached to the posterior corneal surface near the limbus. The lens, vitreous, and fundus were normal but the tension was 35 mm. Schiøtz. The diagnosis was iridoschisis with secondary glaucoma. A broad basal iridectomy led to uneventful recovery. The authors explained the phenomenon as a result of the blow whereby the aqueous was forced into the spongy iris tissue where proteolytic enzymes destroyed the stroma. The pigment thus liberated blocked the drainage channels and caused the secondary glaucoma. (4 figures.)

Morris Kaplan.

Sichel, A. W., and Louw, J. G. **A case of sympathetic ophthalmitis of unusual onset responding satisfactorily to treatment.** Brit. J. Ophth. **32**:180-184, March, 1948.

A 54-year-old farmer with a severe laceration of the right eye refused to have the eye enucleated. It remained moderately painful and three months later was removed when the patient was annoyed by epiphora of the good eye. This irritability and tearing continued for almost a month. Then a mild papillitis and cloudiness of vitreous were noted and one week later typical signs of sympathetic ophthalmia appeared in the anterior segment. The patient was given large doses of penicillin and salicylates and two injections of neoarsphenamine. Large doses of sulphadiazine and sodium iodide and dionin were added. After two months improvement was satisfactory and the corrected vision was normal. The patient has remained well for several months.

Morris Kaplan.

9

GLAUCOMA AND OCULAR TENSION

Allen, T. D. **To prevent cycloplegic glaucoma.** Ophth. Ibero am. **9**:217-220, 1948.

Precautions listed by the author include (1) awareness of the fact that cycloplegic glaucoma may follow the use of cycloplegia; (2) a careful precycloplegic examination; (3) careful records of corneal size and transparency, pericorneal vascular condition, depth of anterior chamber, and other details; (4) tonometry before and after the use of mydriatic or cycloplegic drugs; (5) postcycloplegic test as to possible need for miotics.

W. H. Crisp.

Diaz Domínguez, Diego. **A new technique for cyclodiathermy.** Arch. Soc. oftal. hispano-am. **8**:117-129, Feb. 1948.

The literature on the techniques of cyclodiathermy is reviewed. The corneal complications following the Vogt tech-

nique led many investigators to modify the procedure. The author prefers Thiel's technique of subscleral diathermy-coagulation of the ciliary body, which diminishes the function of the ciliary processes, and provides for aqueous drainage through the suprachoroidal space. The technique is that of cyclodialysis, with the spatula as a diathermy electrode; the spatula is introduced between the sclera and ciliary body until its end appears in the anterior chamber, the current is then turned on, and the spatula moved up and down, coagulating one-third or one-fourth of the ciliary body. The current is disconnected, and the spatula removed. The limited number of cases in which this technique was used does not permit of definite conclusions. The results, however, are not inferior to those of the Vogt cyclodiathermy, at least in simple glaucoma in adults. The addition of diathermy-coagulation to cyclodialysis does not increase the risk of the operation, and the author believes that is it indicated wherever fistulating operations are not suitable.

Ray K. Daily.

Holst, J. C. **The results of subconjunctival iridencleisis with meridional iridotomy in the period 1928-1939.** Acta ophth. **25**:271-278, 1947.

The author discusses 1019 patients with simple glaucoma, on whom 1318 operations had been performed. A period of one year of observation was possible in 455 eyes. Vision was the same or better in 83.4 percent of eyes, and the field of vision was improved in 96.8 percent. Tension was normal without miotics in 79.8 percent, and in a further 12.5 percent it was normal under pilocarpine, which had been ineffective before operation. The chances of maintaining the functions of the eye unchanged are best if the operation is performed early. (3 tables.)

Louis Daily, Jr.

Márquez, M. **Old and new ideas about ocular hypertension and glaucoma.** Ophth. Ibero am. **9**:123-147 (in Spanish), 148-169 (in English), 1948.

The author speaks of these two conditions as more or less distinct entities although they frequently coincide: which one develops sometimes depends chiefly upon susceptibility of the optic nerve to what is ordinarily thought of as normal or relatively normal tension. (Bibliography.)

W. H. Crisp.

Moreu, Angel. **Gonioscopy in glaucoma.** Arch. Soc. oftal. hispano-am. **8**:80-89, Jan., 1948.

Moreu enthusiastically advocate gonioscopy, which he has been doing since 1933. He began with the Troncoso gonioscope and the Koeppe contact lens, and now uses the Goldman contact lens with the slit lamp. For experimental purposes he uses dogs, which are easy to gonioscope. He points out that most of the investigations on gonioscopy were done in the Americas, the Europeans having manifested but little interest in the subject. Supporting his opinions by extensive gonioscopic investigations, he argues against the acceptance of the anatomic structure of the anterior chamber angle as a factor in the pathogenesis of glaucoma. The size of the angle varies, and is subject to changes in the same eye. He has seen acute glaucoma in eyes with wide open angles free of synechia, and chronic glaucoma with a narrow angle and peripheral synechia. Moreau regards the changes in the angle of the anterior chamber as a consequence of glaucoma and not its cause. The early glaucomatous change is an edematous ciliary band, with foci of fine exudate. Gonioscopy makes possible the study of the ocular physiology, and combined with intravenous or intramuscular fluorescin injections it reveals much of the physiology of the aqueous veins and Schlemm's canal. Gonios-

copy is valuable in the study of postoperative results, and the anatomic effects of surgical procedures. The site for cyclodialysis should be selected by gonioscopy. If the cyclodialysis spatula hits where there is a synechia no dialysis results; there is merely a perforation which closes on the following day. Ordinarily after a cyclodialysis a small hematoma fills the dialyzed area, and as the hematoma absorbs, a synechia, which was not there before the operation, is left in its place; the surgical result may nevertheless be good. Following fistulating operations gonioscopy sometimes reveals that there is no fistulization; but the ciliary edema in the ciliary body and processes is gone, and the intraocular tension is reduced. The favorable results are due to the effect of the operation on the uveal circulation. Moreu is a firm believer in the vascular basis of glaucoma. Ray K. Daily.

Moreu, Angel. **Reflections on some points relative to the pathogenesis of true glaucoma.** Arch. Soc. oftal. hispano-am. 8:64-79, Jan., 1948.

Moreu stresses the importance of differentiating between secondary hypertension, caused by obstruction in the angle of the anterior chamber, and true glaucoma caused by a disturbance in the ocular circulation on the basis of a neurovegetative dystonia. Reference is made to the recent investigations of Duke-Elder, Kinsey and Grant, and Barany on the production of aqueous humor, and the investigations on the function of Schlemm's canal are critically analyzed. The author's own experiments with the reaction of Schlemm's canal to puncture of the anterior chamber and the analysis of the aqueous humor withdrawn in the various types of glaucoma are described in detail. As a result of these investigations he sounds a warning on the use of vasodilators, recently advocated in glaucoma; they augment the volume of blood which enters the eye, and in case of inability of this blood to leave the eye through obstructed drainage pathways may precipitate an acute attack. In an eye with good drainage passages vasodilators may be used even in an acute stage. Vitamin P, which diminishes vascular permeability affects favorably the ocular tension and the composition of the aqueous. Ray K. Daily.

Owens, W. C. **Glaucoma following cataract extraction.** South. M. J. 41:357, April, 1948.

A series of 2,086 cases seen at the Wilmer Ophthalmological Institute from 1925 to 1943 was studied. The percentage of all glaucoma cases was 4.2. In the group with intracapsular extraction with round pupil it was 1.6. Most of the prevention of glaucoma is technical, at the time of operation, such as removing all or as much as possible of the lens to minimize postoperative iridocyclitis, the most common cause. Loss of vitreous is reduced by adequate anesthesia, a speculum which does not press on the eye, and detention when possible of a round pupil. Corneoscleral sutures were used to close the wound well and to prevent delayed reformation of the anterior chamber. If it had not reformed at the end of six days, air was injected. To prevent mechanical block by vitreous an adequate peripheral iridotomy or iridectomy should be done at the time of operation.

In treatment of glaucoma that was associated with an acute iridocyclitis, foreign protein and mydriatics were used. When lens material is retained, desensitization with lens protein may help. A trephine operation is advised if these measures fail. In cases without iridocyclitis, miotics were used, and the tension carefully recorded. If operation was necessary, the choice was cyclodialysis, in the upper quadrant if possible, with miotics for at least several weeks afterwards. This operation may be repeated.

If it failed, trephining was recommended.

In only 39.5 percent of cases of glaucoma following cataract extraction was the final vision 20/70 or better. (1 table, references.) Bennett W. Muir.

Posner, A., and Schlossman, A. **The role of inheritance in glaucoma.** Tr. Am. Acad. Ophth. pp. 145-158, Jan.-Feb., 1948. (See Section 19, Congenital deformities, heredity.)

Simonelli, Mario. **The use of prostigmine in the treatment of glaucoma.** Riv. di oftal. **2**:119-124, March-April, 1947.

The author concludes that prostigmine used as a collyrium in three-percent solution induces a miosis and a drop in ocular tension sufficiently marked to make it especially indicated in the therapy of glaucoma. Prostigmine has an action which is more effective than that of pilocarpine and can be compared with eserine. However, it is of prompter action, longer duration, and, above all, does not show the usual secondary reactions characteristic of eserine even though it is used over a long period of time. Finally, prostigmine is completely stable.

The author used prostigmine in 18 cases of glaucoma (6 acute, 4 chronic inflammatory and 8 chronic simple), and in all cases the results were superior to those obtained with pilocarpine. In the patients with chronic inflammatory glaucoma, pilocarpine and prostigmine were used alternately and there was always a rise in tension after pilocarpine and a lowering after prostigmine.

Francis P. Guida.

Thomassen, Thore Lie. **The cause of the increase of tension in iridocyclitis glaucomatosa.** Acta ophth. **25**:243-252, 1947.

Two series of experiments were performed in this investigation. Five eyes with iritis glaucomatosa were subjected to a weight compression of 25 gm. during two minutes and the ocular tension measured before the compression, and 5, 15, and 35 minutes after the removal of compression. The data show that the response of eyes with iridocyclitis with hypertension to compression is the same as it is in simple glaucoma. In the increasing phase of ocular tension there is a distinct relative hypertension and no fall in pressure; in the decreasing phase there is a marked fall in pressure, with no relative hypertension. The fall in pressure in response to compression is believed to be due to the pressing out of the aqueous through Schlemm's canal, which is hampered in the rising phase.

The material for the second series consisted of nine eyes with iridocyclitis glaucomatosa. Curves of the ocular pressure and of the pressure in the episcleral veins were made daily for 12 days. The technic used was identical with that applied to the study of simple glaucoma, except that the tension was taken every hour, instead of every half hour because of the increased sensitiveness of these eyes. The curves of the data thus obtained show that the relations between the ocular and venous tensions are the same in iridocyclitis with high tension and in simple glaucoma. The venous tension is high in proportion to the intraocular pressure in its rising phase, in the decreasing phase the venous tension is low. The changes in the venous tension precede those of the intraocular pressure. The conclusion of the studies is that the rise in intraocular pressure in iridocyclitis glaucomatosa as well as in simple glaucoma is due to functional changes in the vascular system of the eyes. (2 curves.)

Louis Daily, Jr.

Thomassen, Thore Lie. **The arterial tension in glaumatous eyes.** Acta ophth. **25**:253-264, 1947.

A review of former investigations on the arterial ocular tension and its relation to the general blood pressure and the

ocular tension brings out the scarcity of established data. The author's experimental work consisted of measuring with a water manometer the diastolic and systolic arterial tensions in an anterior ciliary artery at the point where it enters the sclera. The pressure was taken at the first discernible pulsation, and at the moment when the artery became empty. The material consisted of 16 glaucomatous eyes, and the ocular tension and the tension in the episcleral vein were taken as well. Because of the great pressure to which the globe must be subjected in these measurements, the arterial tension was taken only a few times daily; it was, however, taken at hours of greatest variation in the ocular tension. The curves of the data show that the arterial tension remains constant despite marked oscillations in the ocular and venous tensions. The instillation of pylocarpine into one eye also failed to affect the arterial tension, while producing a distinct fall in the ocular and venous tensions. Applying these data to the explanation of the pathogenesis of glaucoma the author concludes that the primary change in disturbances of ocular tension takes place in the minute vessels of the eyes, in which resistance to the blood flow becomes reduced; this leads to a rapid rise in the pressure of the capillaries and veins. The increased capillary tension promotes an augmentation in the quantity of aqueous humor with the consequent rise in ocular tension. The rise in the venous tension takes place rapidly, while the increase of aqueous humor takes place more slowly; this conception is supported by the experimental data, which show that the rise in venous tension precedes the rise in ocular tension. Louis Daily, Jr.

10
CRYSTALLINE LENS

Arruga, H. **Comments on cataract extraction.** Arch. soc. oftal. hispano-am. **8**: 5-22, Jan., 1948.

Because a small pupil facilitates the making of a peripheral iridectomy or iridotomy and holds back the vitreous after rupture of the hyaloid membrane, Arruga operates by preference with a pupil of 6 mm. He uses larocain which does not dilate the pupil, or adds 1 percent pylocarpine to instillations of cocain and adrenalin. In restless patients he uses 30 percent alcohol with the akinesis, which prolongs the relaxation of the lids, at the price of a somewhat painful injection, and lid edema. He makes a corneal section, and closes the wound with corneal sutures, using as many as five in restless patients. The corneal section prevents hemorrhage during and after the operation; healing however, is slower, and corneal suturing requires very fine and sharp needles. For this purpose he found the American atraumatic needles inadequate. He makes two peripheral iridotomies. The importance of a good capsule forceps for intracapsular extraction is emphasized and the Arruga forceps is described and illustrated in detail. The anterior chamber is filled with sterile water after loss of vitreous. (11 illustrations.)

Ray K. Daily.

Buffington, W. R., **Congenital ocular anomalies resulting from (a) premature birth (b) rubella infection of mother during pregnancy.** New Orleans M. and S. J. **100**:466-474, April, 1948.

Three cases of bilateral retrolental fibroplasia in premature infants are reported and two cases of congenital cataract in infants whose mothers had German measles in the first two months of pregnancy. Irwin E. Gaynon.

Doherty, W. B. **A discussion of deformities of the shape of the lens. With a report of a case of posterior lenticonus.** Am. J. Ophth. **31**:455-460, April, 1948. (2 figures, 35 references.)

Gill, E. G. **Cataract surgery: recent advances.** South. M. J. **41**:191-197, March, 1948.

The author uses local anesthesia, van Lint akinesia, a keratome incision widened to 180 degrees with scissors, a combination of two corneoscleral sutures, and a 180-degree conjunctival flap closed by additional sutures. The lids are held open, and the eye down with silk sutures, and the lens is delivered by the Verhoeff method. The patient is generally allowed to get out of bed 24 hours after operation. With this technic the author has achieved a visual acuity of 20/25 or better in 90 percent of patients; he has reduced hemorrhage to 3 percent and vitreous loss to 2 percent. He emphasizes that this operation is not designed for speed but for safety and accuracy.

Theodore M. Shapira.

Heinz, K. **Cataract infection in spite of sulfonamid prophylaxis.** Proc. Ophth. Soc. Vienna, p. 29, Oct. 26, 1942.

The right eye of a man, 66 years of age, was operated on by Prof. Lindner for an intumescent cataract extracapsularly with loss of vitreous and subsequent infection. In spite of extensive therapy this eye was lost. Five weeks later a cataract was extracted from the left eye, again with loss of vitreous. On the day of operation patient had received one milk injection and prontosil. Nevertheless this eye also showed signs of severe infection on the sixth postoperative day but the eye recovered after the use of sulfa drugs and injections of milk and typhoid vaccine. The resulting vision was 6/8.

F. Nelson.

Kadesky, David. **A modified forceps for intracapsular extraction of cataract.** Arch. Ophth. **38**:259, Aug., 1947.

The author describes a capsule forceps shaped so that the radius of curvature of the jaws corresponds to that of the average convexity of the anterior surface of the lens. (2 figures.) John C. Long.

Kirby, D. B. **The extraction of cataract in the presence of fluid vitreous.** Am. J. Ophth. **31**:585-606, May, 1948. (2 tables, 15 references.)

Ladato, G. **Concerning a case of bilateral cataracta nigra.** Riv. di oftal. **2**: 145-154, March-April, 1947.

The author discusses one case of bilateral cataracta nigra in which he carried out a histochemical investigation. This revealed the presence of fatty substances which he considers a localized metamorphosis of lenticular protein, especially the amino acids.

Francis P. Guida.

Schulte, D. **Abscess-like collection of pus between the lamina of the posterior lens capsule.** Klin. Monatsbl. f. Augenh. **112**:193-203, 1947.

An eye which had been enucleated because of an acute metastatic panophthalmitis had a collection of more or less encapsulated pus between the lamina of the posterior lens capsule. Such a finding is extremely rare. The author assumes that the leucocytes entered the lens capsule along the zonula and the limiting membrane of the vitreous through the Wieger ligament and the lamina of the zonula. The histologic findings confirm the anatomic concepts concerning the Wieger ligament, the anterior limiting membrane of the vitreous and the connection between vitreous, lamina of the zonula and lens. They also illustrate the lamellar structure of the lens capsule. (8 figures, references.)

Max Hirschfelder.

Velhagen, K., Jr. **Cataract operation in myopia.** Klin. Monatsbl. f. Augenh. **112**: 225-232, 1947.

The author discusses the advantages and disadvantages of intracapsular and

extracapsular cataract extraction in patients with high myopia. The various complications such as loss of vitreous, retinal detachment, iris prolapse and late hemorrhage are statistically compared for the two methods of operation. The author's figures and extensive statistics from the literature are cited. The author prefers intracapsular extraction in high myopia, in spite of a slightly higher percentage of complications. He points out that these complications can be dealt with more easily than in the extracapsular extraction but the latter is often disappointing because of the particularly bad secondary cataract in myopic patients. The average end result with intracapsular extraction was 0.4 vision, whereas in extracapsular extraction it was only 0.28. The author's own figures for vitreous loss in high myopia were 6 percent for the intracapsular and 3 percent for the extracapsular method. (Bibliography.)

Max Hirschfelder.

Williamson-Noble, F. A. **A complication of intracapsular cataract extraction.** Brit. J. Ophth., **32**:161-162, March, 1948.

This very brief article explains the author's technique for extracting a lens after the capsule has ruptured unexpectedly. Rather than use a loop, he inserts two cystitomes into the lens and pulls it out with some pressure assistance of a squint hook. He has used this procedure in three cases. Morris Kaplan.

11

RETINA AND VITREOUS

Arruga, H. **Some observations on the treatment of retinal detachment.** Arch. Soc. oftal. hispano-am. **7**:1001-1008, Oct., 1947.

Advancement in the treatment of retinal detachment has raised the percentage of cures to 70 to 80 percent of the eyes that are operated upon. Eyes with retinal holes, which are operated on before detachment takes place always heal perfectly. In patients who had a retinal detachment in one eye the recognition of early visual disturbances in the other eye may lead to the diagnosis of the retinal hole before the retina becomes detached. In 23 such cases Arruga achieved perfect results, without a diminution in visual acuity, by coagulation with a weak current. Coagulation with a weak current of vacuolar degenerated retinal areas in the remaining eye of a patient who lost the other from retinal detachment is also productive of good results. Poor surgical results, in cases in which one expected success because the retina returned to its normal position after rest in bed, are attributed by Arruga to an increased sensitivity of the choroid, or to the presence of a chronic inflammatory process which is activated by the surgical procedure. There is no way of predicting this unfavorable reaction. Macular holes have a poor prognosis, and their surgery is technically difficult. They are produced not by a pull of the vitreous as is the case with retinal holes in other areas, but by the push of the choroidal exudate on the retina towards the interior of the eyeball. They are round holes, without flaps, and the retina does not flatten after rest in bed. Disinsertions at the ora serrata are never reattached; the surgical goal is here to reattach the retina to the underlying choroid, but not to its original insertion. The lateral portion of the retina must be sacrificed to save central vision. To achieve this it is useless to coagulate at the periphery; the retina should be coagulated so that the disinserted area is thoroughly isolated. Detachments with holes in the lower portion of the retina also have a poor prognosis, chiefly because they interfere but little with vision at first, and patients come to the ophthalmologist after the underlying choroid has degenerated and become incapable of pro-

ducing an exudate. In such cases also coagulation is effective only in isolating the detached retina, but not in reattaching it. Ray K. Daily.

Arruga, H. **Considerations on the treatment of detachment of the retina.** Proc. Roy. Soc. Med. **65**:68-72, Jan., 1948.

The author presents substantially the same material as in the preceding abstract.
F. H. Haessler.

Belmonte González, José. **Experimental vitreous transplantation.** Arch. Soc. oftal. hispano-am. **7**:1091-1096, Nov., 1947.

The technical methods of vitreous transplantation are the same as described by Cutler. Rabbit's vitreous was used in this work. Some was transplanted immediately and others 6 hours, 24 hours, 3 days, or 6 days after the enucleation of the eye. A biomicroscopic study was made in every case. It was found that better results were obtained when fresh vitreous or vitreous obtained only a few hours after the enucleation was used. The donor's eyes were preserved in isotonic saline solution. (Several colored pictures.)
J. Wesley McKinney.

Bockhoven, S., and Levatin, P. **Treatment of Lindau's disease.** Arch. Ophth. **38**:461-467, Oct., 1947.

Lindau's disease is an angiomatosis of the central nervous system characterized by the occurrence of single or multiple hemiangioblastomas in the cerebellum, brain stem or spinal cord, associated with angiomatosis of the retina (von Hippel's disease). The authors report a case of Lindau's disease in a 27-year-old negro. Signs of spinal cord involvement developed. At operation an extensive sclerosing hemiangioma of the cord was found. An asymptomatic angioma was found in the upper temporal portion of the fundus, with marked dilatation of the vein and artery. This was treated by diathermy puncture which largely destroyed the growth but did not completely occlude the feeding blood vessels. The electrocoagulation was carried out without any loss of vision and is regarded as the method of choice in treating retinal angiomatosis. The tumor of the cord was treated by roentgen radiation but further cord involvement occurred.
John C. Long.

Calhoun, F. P. **Observations on the treatment of detachment of the retina.** South. M. J. **41**:311-316, April, 1948.

A normal retina does not become detached. Careful examination with maximum dilatation, repeated especially after bed rest, is of utmost importance. Transillumination should always be done. The author prefers local anesthesia, with O'Brien or Van Lint akinesia, without subconjunctival injection. Muscles are retracted by a suture passed beneath them rather than with a muscle hook. He prefers to localize a hole ophthalmoscopically after a test application of nonperforating diathermy. Then the initial localization is surrounded by a double ring of partially penetrating applications with a 0.5-mm. electrode at intervals of three millimeters. Frequent ophthalmoscopic examination during operation is stressed. Holes for drainage should be a short distance from the retinal hole rather than right over it, and cutting current, if available, is used, with a 1.5-mm. Kronfeld or Pischel electrode. If air is injected it should be through the flat portion of the ciliary body away from the area of diathermy, for which a large pointed electrode 2 to 3 mm. long is used first, then a needle and syringe. The amount of air usually is 2 to 3 cc. More often air is put into the anterior chamber through a paracentesis wound, at the end of operation. One half to one cc. usually is enough. The causes of failure are sometimes quite obvious, such as large or multiple rents, or trac-

tion bands, but often there is no obvious reason. (2 figures, discussion, references.)

Bennett W. Muir.

Doggart, J. H. **The prognosis in macular lesions.** Tr. Ophth. Soc. U. Kingdom 65:347-353, 1945.

The ophthalmologic picture of primary degeneration may closely simulate that of changes due to previous inflammation or trauma. The progress of a lesion is difficult to determine without repeated examinations as deterioration may be arrested at any stage.

The first step towards prognosis is the attempted recognition of the similarity of the lesion to one in one of the groups identified by authoritative observers. Systematic exploration of the whole fundus and the comparison of the two eyes are helpful in diagnosis as well as prognosis.

The prognostic value of case records is enhanced by a series of drawings indicating the size and position of macular changes at successive examinations.

Beulah Cushman.

Friede, R. **The nature of inherited retinitis pigmentosa.** Klin. Monatsbl. f. Augenh. 112:214-221, 1947.

The factors which conceivably can play a part in the pathogenesis of retinitis pigmentosa are discussed. Such inherited factors may act locally or generally. The anatomic or pathologic structure of the choriocapillaris may be involved, as it influences the flow of blood and, therefore, the nutrition of the underlying retina. There is often only little choroidal sclerosis in retinitis pigmentosa. In the author's opinion, the lamina vitrea plays the primary and most important part in the development of retinitis pigmentosa. It is the vitrea which regulates the nutrition of the neuroepithelium by osmosis. Hyalinization of this structure leads to serious disturbance of the metabolism of the retina. It also prevents the passage of vitamin A and produces the accompanying hemeralopia. The possibility that retinitis pigmentosa is only a part of a generalized disturbance is discussed. Patients in whom the disease is associated with inherited deafness or with the Laurence-Moon-Biedl syndrome are cited. Leber's theory of an overstimulation of the retina by light and the theories of a primary liver disturbance are mentioned, but their correctness is held to be questionable.

Max Hirschfelder.

Gartner, S., and Priestley, B. S. **Transplantation of the vitreous.** Arch. Ophth. 38:487-493, Oct., 1947.

Transplantation of vitreous has been successfully performed in rabbit eyes. Vitreous from the other eye of the same rabbit or from the eyes of other rabbits was used, as well as vitreous from the human eye and from the kitten eye. A method of simultaneous injection and withdrawal of vitreous with a specially devised double syringe and needle arrangement was the only method found to give regularly successful results. It was found that unless the injection of new vitreous was carried out simultaneously with the withdrawal of vitreous extensive hemorrhages and deteriorative changes followed.

Further studies are needed before the method is applicable to the human eye.

John C. Long.

Gordon, D. M. **The experimental treatment of retinitis pigmentosa.** Tr. Am. Acad. Ophth. pp. 191-195, Jan.-Feb., 1948.

The records of 128 patients who received a reasonable amount of treatment by Filatov's tissue therapy are critically reviewed. This therapy consists of injections of cod liver oil and the implantation subconjunctivally or subcutaneously of placenta and other substances ranging from aloes to ovaries. These patients, 16 to 73 years of age, had visions that ranged from the ability to barely count fingers

to 20/20. In 26 percent there was slight improvement in vision in at least one eye; of these 11 showed slight improvement in visual fields, 4 in light adaptation and 2 were doubtful. The visual improvement was so slight, however, that one wonders whether or not the greater urge to see was not the most important factor. No change in the fundus was observed. Temporary improvement is also obtained by large doses of nicotinic acid and vasodilators and there the duration of such improvement as well as the secondary reaction is questionable. This treatment is not advised until its advantages and disadvantages have been much more thoroughly investigated. Chas. A. Bahn.

Hayden, R. **Retinitis pigmentosa with unilateral involvement of fundus.** Proc. Ophth. Soc. Vienna p. 16, May 18, 1942.

A woman, 39 years of age, noted progressive deterioration of vision and increasing night blindness for the last five years. The corrected vision in the right eye was normal, but dark adaptation curves showed diminishing of threshold values. The left eye showed typical advanced pigment degeneration of the retina, minimal visual acuity, concentric contraction of the visual field to 10 degrees and a high degree of hemeralopia. Since both eyes had hemeralopia the retinitis pigmentosa cannot be called unilateral though the fundus of the right eye appeared objectively normal. F. Nelson.

Kaplan, M., Morax, P. V., and Bernard, J. **The Tay-Sachs type of amaurotic family idiocy: a case report.** Ann. d'ocul. 181:32-35, Jan., 1948.

The patient was a practically blind, one and one-half year old boy of Oriental-Jewish extraction, whose father and mother were cousins. The direct and indirect pupillary reactions were diminished, but equal, and most of the other ocular reflexes were absent. The macular region was observed as a yellowish disc with a bright, red central depression; otherwise, the fundus was objectively normal. Chas. A. Bahn.

Kurz, O. **Differential diagnosis of lesions of the macula.** Ophthalmologica 114: 262-273, Oct.-Nov., 1947.

Three cases of lesion in the macula are reported in detail: one of central serous chorio-retinitis (corresponding to the central angiospastic retinopathy of Gifford and Marquardt), one of hypertensive retinopathy and one of a congenital familial anomaly of the macula. The importance of the distinction between cystoid macular edema and localized subretinal exudates is stressed. Examination of the macula by means of the slitlamp, the binocular corneal microscope and the fundus contact lens gives clues unobtainable by binocular ophthalmoscopy in mixed or redfree light.

Peter C. Kronfeld.

Lindner, K. **Bullous retinal detachment cured by waiting and operation.** Proc. Ophth. Soc. Vienna p. 23, June 29, 1942.

An almost total bullous retinal detachment of two or three weeks duration was found in the right eye of a 52-year-old woman. Only in the lower nasal quadrant was the detachment flat. A tear was found. Since the author felt that the prognosis was hopeless he waited four months before he decided to operate on the eye. The retina returned to its normal site and remained in place since, but the vision regained was only 3/24 as a result of the long delay. F. Nelson.

Matteucci, P. **Papilloretinitis of arterial hypertension and papilledema.** Riv. di oftal. 2:105-111, March-April, 1947.

One case of "cerebro-retinal" edema is reported. On the basis of this observation and of studies of retinal venous and arterial pressure studies on patients with

various types of arterial and intracranial hypertension, the author discusses the pathogenesis of hypertensive retinopathies. He also emphasizes the diagnostic value of the retinal venous pressure which seems to bear a close relationship to the intracranial pressure.

Francis P. Guida.

Michaelson, I. C. **Intra-mural new vessels in an occluded retinal vein.** Brit. J. Ophth. **32**:164-166, March, 1948.

A 60-year-old woman developed an obstruction of a branch of a superior temporal vein near the optic disc. Five months later examination revealed numerous newly-formed collateral vessels between the affected and unaffected branches of the vein. Within the opacified walls of the obstructed vessel, two well formed veins were found extending into the distal column of blood. One of these vessels could be seen leaving the affected vessel and draining into an unobstructed vein.

Morris Kaplan.

Missiroli, Giuseppe. **Bilateral symmetrical paramacular tapetoretinal degeneration.** Boll. d'ocul. **26**:655-660, Oct., 1947.

The only complaint of the patient, a 24-year-old female medical student, was that she became tired after reading. The parents were not related; there was no eye disease in the family and in two siblings. With correction of a medium degree of hypermetropic astigmatism, the patient has a visual acuity of 10/10. There was an absolute paracentral scrotoma for colors and a relative one for white in both visual fields which were peripherally normal. Color sense and adaptation were normal. In both retinas temporally from the macula lutea, there was an oval area of yellow-brown color, measuring 2 by 1½ papillary diameters, pigmented and sharply outlined; in the right retina this area was crossed by a retinal artery. For four years the lesions and the functional findings did not change; in the fifth year of observation, a slight but definite enlargement of both retinal lesions, to 3 by 2 papillary diameters, was found. The disease is one of the group of familial macular degenerations. The author suggests that the cases with paramacular localization may occur more often but are not described frequently because visual disturbances are missing; the present case would not have been detected were it not for the asthenopic symptoms caused by the astigmatism. (1 colored fundus picture, 6 references.)

K. W. Ascher.

Morgan, O. G. **A case of crush injury to the chest associated with ocular complications.** Tr. Ophth. Soc. U. Kingdom **65**:366-368, 1945.

A small boy who was run over by a cart sustained minimal injuries to the chest. The following day he developed a typical picture of angiopathia retinae traumatica. He had a subconjunctival hemorrhage on the inner side of each cornea and three days later vision was reduced in the left eye to 6/12. The left fundus showed numerous whitish patches, some small hemorrhages along the main vessels and edema of the macula. The right eye showed a few whitish patches but no hemorrhages. The condition gradually cleared in three weeks and visual acuity was 6/6.

This must be an unusual complication of a minor chest injury. (1 colored plate.)

Beulah Cushman.

Rosen, Emanuel. **Solar retinitis.** Brit. J. Ophth., **32**:23-35, Jan., 1948.

In the 23 cases described, exposure occurred for a few minutes to an hour and was not confined to direct gazing into the sun. Several cases of severe sun blindness were caused by watching the sun's reflection, as in a lake or in a bucket of water. In every case there were one or two easily

visible macular holes and heavy damage to vision. The destruction of the retinal tissue was irremediable. The ophthalmoscopic picture is quite characteristic; in the macula a deep crater, deep crimson in color, one-eighth disc diameter in width, the edges of which are sharply cut and irregular in shape, is surrounded by a soft cloud of pigment. (14 Figures.)

Morris Kaplan

Rosengren, B. **The operative treatment of retinal detachment.** Acta ophth. **25**:111-126, 1947.

Among the factors accounting for the failure of operations for retinal detachment Rosengren considers errors in localization and faulty cauterization as insignificant, and believes that the majority of failures are due to the lack of contact between the retina and choroid. If the subretinal fluid is not withdrawn, healing is impossible. To maintain contact between the retina and choroid Rosengren injects air into the vitreous, and places the eyeball in such position that the hole is upward. The air bubble forces the retina against the choroid by pushing against it. The author advises bed rest until the elevation within the cauterized area has completely disappeared, that is for about five to six weeks. He keeps a binocular bandage for three to four weeks. The tabulated data on 100 patients show 81 cured. Reference is made to the author's former report on the technique of coagulation, in which he advocates nonperforating electrocoagulation with a ball electrode 1.25 to 1.00 mm. in diameter. (4 figures, 6 tables.) Ray K. Daily.

Verrey, F. **Myotonic dystrophy associated with degeneration of the macula.** Ophthalmologica **114**:281-284, Oct.-Nov., 1947.

A typical case of myotonic dystrophy showed the following eye findings: bilateral ptosis, limitation of all ocular movements, slight reduction of corneal sensibility and fine, but typical lens opacities. The unusual finding was a bilateral degeneration of the macula (multiple yellowish dots within the retina) without gross visual impairment.

Peter C. Kronfeld.

Verrey, F. **Symmetrical involvement of the retinae in pigmentary degeneration.** Ophthalmologica **114**:278-280, Oct.-Nov., 1947.

A white female patient, 51 years of age, complained of impaired vision in the dusk for the last ten years, and increasing reading difficulty for the last five years. Her vision was *20/20* in the right eye and *20/33* in the left. The fundus findings were those of retinitis pigmentosa confined to symmetrical sectors in the two eyes. The upper-temporal quadrants with portions of the adjacent quadrants had remained uninvolved, so that the lower halves of the visual field were almost normal. In the affected sectors the retinal vessels were much narrower than in the unaffected areas. Other members of the family could not be examined. Peter C. Kronfeld.

12

OPTIC NERVE AND CHIASM

Friedenberg, Sidney. **Tryparsamide optic neuritis treated by 2,3, Dimercaptopropanol** (B.A.L.). J.A.M.A. **135**:1072, Dec. 20, 1947.

The author presents the first recorded case of tryparsamide optic neuritis successfully treated with 2,3, Dimercaptopropanol (B.A.L.). The arsenicals are thought to be toxic because they block the functioning of physiologically essential chain groups within the cells by combining with them. B.A.L. competes successfully for the arsenic with the sulfhydryl bond (the most vulnerable) by forming a stable compound with the arsenic which is rapidly excreted in the urine.

After tryparsamide injections the patient had loss of the inferior portions of the visual fields and general constriction. The last functions were recovered because of prompt B.A.L. therapy.

O. H. Ellis.

Igersheimer, Joseph. **Binasal hemianopsia.** Arch. Ophth. **38**:248-258, Aug., 1947.

A case of binasal quatranopsia with central scotoma of the right eye in a 59-year-old man is reported. Exploratory operation showed a supraclinoid type of saccular aneurysm lateral to and apparently covered by the nerve. Diagnostic aspiration of blood from the aneurysm was done. Following the surgery there was marked loss of vision of the right eye but very considerable improvement in the vision of the left. The causes of binasal hemianopsia are discussed in some detail. The author concludes that the field of action in such cases is not the chiasm but the short portion of the intracranial part of the optic nerve in front of the chiasm. If the lesion is unilateral and the other optic nerve is also involved, this involvement can be explained only mechanically by pressure against the nerve, probably of sclerosed vessels, or by a local nutritional deficiency. The author believes, with Caramazza, that the presence of binasal hemianopsia combined with unilateral central scotoma points to a vascular disease, in the middle fossa and not a tumor of the pituitary body or a suprasellar tumor. John C. Long.

Jefferson, Geoffrey. (The Doyne lecture) **On compression and invasion of the optic nerves and chiasma by neighboring gliomas.** Tr. Ophth. Soc. U. Kingdom **65**: 262-304, 1945.

The author describes in great detail his clinical data on eight patients with gliomas near the optic nerve and chiasm and discusses the significance of his findings to an understanding of the pathologic process and its clinical manifestation. Beulah Cushman.

Pallarés, J. J. **The occurrence of several cases of optic neuritis, of undetermined etiology, during an epidemic of neurotropic virus infections in Valencia.** Arch. Soc. oftal. hispano-am. **8**:30-44, Jan., 1948.

From January to July, 1947, Pallarés saw four cases of isolated, unilateral, retrobulbar optic neuritis with an acute onset and terminal atrophy. Before the development of optic atrophy peculiar perivascular foci appeared at the point of emergence of the vessels from the papilla which seemed to be typical of this type of neuritis. Therapy was futile in three patients and the fourth improved on therapy with colloidal sulfur. Reference is made to Benedict's study of 225 cases of retrobulbar neuritis. Because the author's cases occurred following an epidemic of neurotropic virus diseases, it appears probable that a virus infection is the cause of the optic neuritis. Because of the perivascular foci it is suggested that the virus is transmitted along perivascular lymph spaces. (8 visual fields. 4 fundus drawings.) Ray K. Daily.

Rabadán Fernández, Pedro. **Posthemorrhagic, unilateral atrophy of the optic nerve.** Arch. Soc. oftal. hispano-am. **7**: 1193-1198, Dec., 1947.

Complete and permanent loss of vision occurred in the right eye of a woman, 24 years old four days after a severe hemorrhage from the stomach. When seen five days later, she had no pupillary reaction to light, no light perception, the optic nerve was pale, the arteries narrow, and there was a slight peripapillary haziness. Two weeks later the optic nerve presented a picture of post-neuritic atrophy.

Ray K. Daily.

Vogelsanger, W. **A case of optico-chi-**

asmatic archnoiditis. Ophthalmologica **114**:273-277, Oct.-Nov., 1947.

In a white man, aged 22 years, without any tangible antecedents, the vision of both eyes became rapidly reduced to light perception in small islands of the visual field. The ophthalmoscopic appearance of the discs and the results of a thorough general examination were normal. Within the next few weeks the peripheral vision improved spontaneously and only central scotomata persisted. The discs, however, became pale with distinct borders and normal vessel caliber. The gradual recovery of the visual field was interrupted by two fairly acute setbacks, one nine weeks and another 16 weeks after the onset of the visual disturbance. A few days after the latter the chiasma was explored surgically. A heavy arachnoiditic strand was found crossing both optic nerves from above just in front of the anterior angle of the chiasm. This strand was coagulated and severed. The author reports a very marked improvement in vision after the operation. After a few more spontaneous fluctuations the final vision was 20/20 in one eye and 20/200 in the other. Both discs remained snowy white.

Peter C. Kronfeld.

Werner, L. E. **Retrobulbar neuritis.** Tr. Ophth. Soc. U. Kingdom **65**:376-393, 1945.

The syndrome of retrobulbar neuritis consists of: 1. rapid loss of vision in one or both eyes; 2. presence of central or paracentral color scotoma; 3. normal fundus in 85 percent of the cases and swelling of the disc in 15 percent; 4. pain on movement of the eyes and on pressure of the globe; and 5. occasional peripheral field defects.

The immediate treatment advised by the author is the daily intraorbital injection of 1 cc. of one-percent acetylcholine solution preceded by 0.25 cc. of novocaine with no adrenalin. Irrigation of the sphenoidal sinus, the removal of teeth that may have apical abscesses and the use of foreign proteins and sulfadiazine are considered necessary. The consultation with the neurologist can come later.

Beulah Cushman.

13

NEURO-OPHTHALMOLOGY

Esposito, A. C. **Acute syphilitic bilateral total ophthalmoplegia.** Arch. Dermat. and Syph. **55**:686-690, May, 1947.

The author reports a case with diplopia, bilateral ptosis and bilateral third nerve paralysis with loss of pupillary reaction to light and in accommodation. The Wassermann reaction in the spinal fluid was positive and a tabetic type of gold curve was found. The patient responded to potassium iodide drops, bismuth subsalycilate and tryparsamide therapy.

Irwin E. Gaynon.

Focosi, M., and Levi, M. **A case of myasthenia gravis with predominantly ophthalmoplegic signs; diagnostic value of certain functional and laboratory tests.** Boll. d'ocul. **26**:545-561, Sept., 1947.

Sometimes the differentiation of myasthenia gravis from chronic progressive nuclear ophthalmoplegia may become difficult. A 46-year-old man developed a partial paralysis of his left oculomotor nerve followed by ptosis of the right upper lid; later, his legs became weak and occasionally had slight cramps; there was no increase of symptoms during the day and the degree of the ptosis varied irregularly. Botulism and syphilis were excluded and the differentiation between myasthenia gravis and progressive nuclear ophthalmoplegia was undertaken by further study. Basal metabolism was plus 15 percent; lymphocytosis and eosinophilia were discovered in repeated blood counts. The beta-glycerophosphatase of the blood serum was markedly diminished; the blood serum contained

normal amounts of both calcium and potassium, and its inorganic phosphorus content was low. After oral administration of potassium chloride, the potassium content of the blood serum remained high for a longer period than in normal individuals; prostigmine administration had a favorable influence on all the muscle functions. The diagnosis of myasthenia gravis was accepted. K. W. Ascher.

Kravitz, Daniel. **Visual-field interpretations in chiasmal lesions.** Am. J. Ophth. 31:415-426, April, 1948. (10 figures, 6 references.)

Marín, Amat, M., and Marín Enciso, M. **Foster-Kennedy syndrome with unilateral exophthalmos in a child 3 years old.** Arch. Soc. oftal. hispano-am. 7:1190-1192, Dec., 1947.

A 3-year-old child, who had fallen on the floor, was brought for consultation because of exophthalmos of the left eye. She had a 6-mm. exophthalmos, hyperopia of 11 diopters in the left eye, and of 2 diopters in the right, atrophy of the right optic nerve and a choked disc in the left eye. X-ray examination of the skull revealed an osseous lesion in the roof of the left orbit in the region of the small ala of the sphenoid. A fracture of the small ala of the sphenoid and a congenital neoplastic or vascular lesion were considered in the diagnosis.

Ray K. Daily.

Mooney, A. J. **Visual manifestations of head injuries,** Tr. Ophth. Soc. U. Kingdom 65:394-404, 1945.

The author reviews 16 cases of injury to the optic nerve from road accidents. Fractures of the base of the skull involving the sphenoid bone and injuries of the external angular process of the frontal bone were common and were primary factors in lesions of the subchiasmal pathway. The visual nerve fibers are especially exposed to injury in the optic canal because of their close relationship to the bone in the case of fracture, and the limited area in which expansion can take place during hemorrhage into the vaginal space.

X-ray examination of the foramen was done routinely, but in no case did it reveal a lesion. Ocular paralysis co-existed with damage to the optic nerve in two cases only. If combined second, third, fourth and sixth nerve lesions co-exist it points toward basal hemorrhages with some infiltration into the optic canal. The weight of evidence suggested that severe lesions are due to laceration of the optic nerve and mild lesions to rupture of the nutrient vessels with or without bleeding into the sheath, although these conclusions are based entirely on theory.

Prognosis should be guarded. Improvement may take place in the field more than a year after the accident. If the margin of the defect in the visual field is shelving, the lesion is probably not stationary and improvement can reasonably be expected. A steep margin usually indicates a stationary and permanent lesion. If no perception of light is present two months after the accident, the disc pale, and the pupils inactive a bad prognosis can be given. Beulah Cushman.

Roessler, F. **Quadrant hemianopsia. (Observation with post-mortem findings).** Proc. Ophth. Soc. Vienna p. 17, May 18, 1942.

A 56-year-old man suffered a loss in three quadrants of both visual fields after sudden dizziness. Only the left lower quadrants were partly preserved. The patient died three days later of apoplexy. Post-mortem examination revealed thrombosis of the right and left arteria vertebralis, pronounced sclerosis limited to the posterior central arteries and cystic degenerations in both occipital lobes.

F. Nelson.

Rubino, A. **"Morgagni's syndrome" with upper quadrant bitemporal hemianopsia associated with partial retinitis pigmentosa.** Riv. oto-neuro-oftal. **22**:237-252, July-Aug., 1947.

In a woman, 51 years of age, with obesity which started at the time of the menopause, hypertension, frontal headaches and other symptoms of the syndrome of Morgagni, radiographic evidence of an internal frontal hyperostosis of the skull were associated with a superotemporal heteronymous hemianopsia and a partial pigmentary degeneration in the lower nasal sector of the retina. The pigmentary degeneration of the retina is ascribed to a lesion of the "retino-hypothalamic" system. The bitemporal hemianopsia is a part of the Morgagni syndrome and must be considered an expression of a chiasmatic involvement.

Melchiore Lombardo.

Sedgewick, R. P. **Pure visual verbal agnosia with spatial disorientation.** Bull. Los Angeles Neurol. Soc. **13**:64-66, March, 1948.

A patient had visual verbal agnosia, which is due to a subcortical lesion, but no agraphia, which is a cortical function. He could copy letters, but was unable to recognize them. He also had spatial disorientation, in that he had lost the power to revisualize objects, right homonymous hemianopsia, and retinal arteriolar sclerosis. At autopsy a softening of the brain in the distribution of the left posterior cerebral artery was found. O. H. Ellis.

Westerlund, E. **Ophthalmoplegia interna.** Acta ophth. **25**:201-206, 1947.

The literature on ophthalmoplegia interna is reviewed, and four cases, occuring within a period of three months, are reported. The age of the patients was 11, 45, 47, and 24 respectively. The observation period was from three to five months. Two of the patients improved within this time, one recovered completely, and one showed a tendency to improvement. One patient complained of transitory headache. The disease in these patients was believed to be of undetermined infectious origin, as trauma, toxemia and lues could be excluded. Ray K. Daily.

14

EYEBALL, ORBIT, SINUSES

Campos, R. **Angioma cavernosa of the orbit with smooth muscle fibers.** Riv. di oftal. **2**:81-104, March-April, 1947.

A woman, 53 years of age, had a slowly progressive unilateral exophthalmos. The first exploration of the orbit revealed a vascular tumor and brought about a transitory decrease in exophthalmos. Within a month the exophthalmos began to increase and vision began to fail. A superior orbitotomy allowed the removal of a retrobulbar tumor, the size of a pigeon's egg. Histologic examination revealed an angioma cavernosa in an advanced stage of fibrosis. In addition to the usual elements of blood-filled cavities, fibrous masses, lymphatic nodules, cellular infiltration, thrombosed vessels and hypertrophic walls, many strands of smooth muscles were found in a somewhat disorganized arrangement. Special mention is made of the infrequency of variations of the exophthalmos in angiomata cavernosa of the orbit. The origin of the smooth muscle and of the mechanism of formation of angioma is discussed. Francis P. Guida.

Carelli, P. V., and Cangelosi, J. P. **Angiosarcoma of the orbit.** Am. J. Ophth. **31**:453-456, April, 1948. (3 figures, 13 references.)

Fritz, M. H., and Hogan, M. J. **Fat embolization involving the human eye.** Am. J. Ophth. **31**:527-534, May, 1948. (6 figures, 9 references.)

Godtfredsen, Erik. **Studies on orbital tumors. Exophthalmos due to malignant tumors in the paranasal sinuses.** Acta ophth. **25**:295-310, 1947.

Of 14 patients with paranasal sinus carcinomas penetrating into the orbit, 10 were over 60 years old, 3 were between 50 and 59, and one was a 3 year old boy. Eight of the patients were women. The origin of the tumor in eight was the antrum, in five the ethmoids, and the maxillo-ethmoid cells in one. The disease is characterized by early exophthalmos, with or without trigeminal neuralgia, dislocation of the eyeball upward and temporally, obliquity of the palpebral fissure, disturbances of motility, palpable mass in the orbit, and visual disturbances. In 10 patients the initial symptom was exophthalmos, associated in four with homolateral pain in the maxillary area. By the time the diagnosis was made all 14 patients had exophthalmos, and 9 had trigeminal neuralgia. The initial symptoms came from the nasal region in only one patient, and there were nasal symptoms in only five. Metastasis to the cervical glands were insignificant. Naso-pharyngeal tumors, which are frequently sarcomas, must be considered in the differential diagnosis. They occur in younger individuals and nasal symptoms, ophthalmoplegias, and metastasis to the cervical glands are pronounced. An early diagnosis is important, because the prognosis is good if operation or irradiation are instituted early. (7 illustrations.)

Louis Daily, Jr.

Godtfredsen, Erik. **Studies on orbital tumors. Nature and incidence of orbital tumors over a period of 15 years, (1932-1946).** Acta ophth. **25**:279-293, 1947.

This is an analysis of the material of the Eye Department of Karolinska Sjukhuset, which is the largest university clinic in Sweden. There were 78 patients with orbital tumors, about 1 percent of admissions, and in 56 cases the diagnosis was verified histologically. Two-thirds of the tumors were primary orbital, originating in decreasing order of frequency from the lacrimal gland, nervous tissue, bone and vascular tissue. Two-thirds of the secondary tumors were extensions from the nose, and one-third was due to ocular neoplasm. Histopathologically half of the verified tumors were malignant. Because of the compression of the optic nerve and retinal vessels three-fourths were considered malignant biologically. Therapy is surgical and radiological, or a combination of both. It is emphasized that diagnosis and treatment call for close cooperation between ophthalmologists, roentgenologists, neuro-surgeons, oto-rhinologists, internists, and histopathologists. (1 table.)

Louis Daily, Jr.

Greear, J. N., Jr. **The use of buccal mucosa in the restoration of the orbital socket.** Am. J. Ophth. **31**:445-453, April, 1948. (30 references.)

Inigo, L. **Ophthalmoeuliasis interna. Report of a case.** Arch. Soc. oftal. hispano-am. **8**:45-63, Jan., 1948.

Ophthalmoeuliasis is the term applied to invasion of the eyeball by a parasite in its larval stage, and this, Inigo believes, is the first case of this type reported in Spain. An 11-year-old girl awakened during the night with an intense pain in the left eye, which radiated to the whole side of the head. The pain subsided within several hours, and she went back to sleep, but arose next morning with slight discomfort in the eye. During the next two months she developed a violent iridocyclitis with synechia, pain in the eye, and disturbance of vision. In the iridocorneal angle a whitish-yellow cylindroid body, about 7 to 8 mm. in length, and 1¼ mm. thick was found. The ocular tension was raised, and vision reduced to perception of large

objects. The parasite was extracted, and found somewhat adherent to the iris, and some iris pigment came away with it. The patient made a prompt and complete recovery within ten days. Examination of the cornea with the slit-lamp revealed a small punctiform corneal opacity, through the entire thickness of the cornea which was probably the point of entrance of the parasite. It was a larva of Hipoderma movis, which is abundant in the Iberian peninsula, and a frequent cause of diseases of cattle. Ray K. Daily.

Lavery, F. S. **Post-operative intraocular infection controlled by penicillin.** Brit. J. Ophth. **32**:247, April, 1948.

A case of intraocular infection four days after an extracapsular cataract extraction is reported. Pus was present in the anterior chamber. Fifty thousand units of penicillin were injected subconjunctivally three times at 24 hour intervals, and massive doses were injected parenterally for four days. The eye improved rapidly, and the patient was discharged from the hospital with good light projection. Subsequently the eye was found to have a corrected vision of 6/6.
Orwyn H. Ellis.

Rebello Machado, Nicolino. **A case of bacteriemia with bilateral orbital cellulitis and thrombophlebitis of the cavernous sinus. Recovery.** Rev. brasil. oftal. **6**:145-171, March, 1948.

The patient was a physician aged 37 years. The initial condition was an abscess of the epiglottis which occurred about the middle of June, and which was neglected by the patient. He first sought professional assistance after six days, when he was already in a state of advanced toxemia. Within two weeks he sustained an abscess of the left tonsil, which he himself opened. Next came a right peritonsillar abscess, and an arthritis of the left knee. There followed right exophthalmos, and during the next three weeks the left orbit became involved with the typical picture of thrombophlebitis of the cavernous sinus. The infective process is thought to have reached the lesser circulation by way of the lingual vein, the internal jugular, the brachiocephalic, and the superior vena cava. Significant details of the anatomy of the cavernous sinus are cited. The history of a chill with headache, septic temperature, swelling of the eyelids, and exophthalmos beginning on one side and extending to the other in a day or two suggests thrombosis of the cavernous sinus. Treatment in hospital included penicillin, streptomycin, Cibisol (a sulpha drug to which major credit is given), Heparin, and Dicumarol. Recovery was complete. (3 illustrations, references.)
W. H. Crisp.

Rosen, E. **An implant with bridges for attachment of muscles.** Brit. J. Ophth. **32**:166-170, March, 1948.

The author designed an acrylic implant bearing six bridges to which the muscles can be attached. The implant is a truncated cone with a convex base; its anteroposterior diameter is 18 to 24 mm. and the diameter of the base measures 16 to 18 mm. After severing each muscle, plain 0000 gut sutures are placed in it and after the enucleation and insertion of the implant the muscle is brought through the bridge and sutured back upon itself. Tenon's capsule comes back into proper anatomical position and is left unsutured. The conjunctiva is then sutured in a horizontal line with very close approximation of interrupted sutures. The implant cannot be expelled and its mobility is unquestioned. The plastic bridges may be supplanted by metal bridges so that accurate X-ray study can be made of any orbital shift in the implant. (2 figures.) Morris Kaplan.

Rundle, F. F. **Some observations on exophthalmos.** West. J. Surg. **55**:578-583, Nov., 1947.

The author describes the orbital contents, and lists the causal mechanisms of exophthalmos. In post-mortem examinations of a group of thyrotoxic patients with exophthalmos, fat deposition accounts for 70 percent of the total bulk increase and is mostly in the fibro-fatty tissue.

Clinically exophthalmos is only one sign of orbital overfilling. Lid protrusion is another and far more reliable sign, best determined not with the eyelids open, but lightly closed. A widened palpebral aperture is sometimes misleading. Examination with the lids closed is also helpful in determining unilateral lid protrusion. The occasional difficulty in diagnosing exophthalmos because of the wide variation in normal persons is mentioned. The best method is periodic, say monthly, measurements and plotting of the readings. (3 figures, 1 table, 1 chart, references.)

Bennett W. Muir.

Salgado Benavides, E. **Penicillin in the treatment of ophthalmitis neonatorum and septic endophthalmitis.** Arch. Soc. oftal hispano-am. **7**:1121-1128, Nov., 1947.

Good results were obtained by the use of penicillin in the treatment of these infections. Large doses are needed and are administered locally and parenterally. The intravitreous injection of penicillin was considered dangerous and was not effective in controlling the infection.

J. Wesley McKinney.

Schultz, Abraham. **Bilateral chalcosis lentis with endophthalmitis of the right eye. Report of a case.** Am. J. Ophth. **31**: 463-466, April, 1948. (1 figure, 7 references.)

Valière-Vialeix. **Myositis and subacute orbital cellulitis.** Ann. d'ocul. **181**:1-31, Jan., 1948.

A 57-year-old man developed blepharoconjunctival edema with exophthalmus on the right side and subsequently on the left. Vision in the right eye was soon reduced to light perception, in the left, to 0.5. In both discs a glaucoma-like excavation was observed, though the ocular tension in both eyes remained normal and the field of the left eye was approximately normal. The motility of the left eye was slightly limited vertically and horizontally. The general well-being was normal, and bodily examinations and serological tests were essentially negative. A resection of the lateral orbital wall on the left side was first performed under local anesthesia. The external rectus muscle was much enlarged. Fifteen days later a fistula with suppuration developed. Under general anesthesia, a large orbitotomy was then performed. Lardaceous edema in the orbital cone was observed. The fistulous tract was curetted and a mass of inflammatory tissue removed. Healing followed with residual ptosis. Microscopic study of the inflammatory tissue revealed only the usual cellular changes of chronic inflammation. The inflamed lacrimal gland contained lymphoplasmocyte infiltrations along the blood vessels and gland acini. The inflammatory process involved especially the muscles and interfascicular septa. The symptomatology, pathology, and evolution of the condition are discussed at some length. The differential diagnosis involved: 1. malignant thyrotrophic exophthalmus; 2. Mikulicz's disease; 3. blood dyscrasias such as leukemia; 4. chronic and acute inflammatory orbital diseases such as chronic myositis and phlebitis. All these have been classified as inflammatory pseudo-tumors. Pathologically, they include inflammatory edemas as well as diffuse and local inflammatory cellular changes of different types and severities.

In the case reported, the diagnosis of subacute myositis and orbital cellulitis was based on the inflammatory and degenerative changes in the muscles and their sheaths. The etiology is not definitely understood. A pre-existing constitutional vascular degeneration in the orbit is presumed to have been followed by an inflammatory process due to an undetermined toxin. Chas. A. Bahn.

15

EYELIDS, LACRIMAL APPARATUS

Bangerter, A. **The treatment of stenosis of the lacrimal canaliculi.** Ophthalmologica **114**:195-202, Oct.-Nov., 1947.

Both canaliculi of one eye of a young ex-soldier had become completely obliterated as an aftermath of a severe acute conjunctivitis. The author repaired this "stenosis" by making a direct anastomosis between the conjunctival and the lacrimal sac. The lacrimal sac was exposed through the usual incision for dacryocystorhinostomy. The sac was opened at the anterior junction of its medial and lateral walls. The latter wall was freed all the way back to the posterior crista. Through a conjunctival incision just anterior to the caruncle the tissues of the inner canthus were split into an anterior and posterior layer, until the previously freed lateral wall of the tear sac was exposed. A broad anastomosis between conjunctiva and tear sac was made by suturing the free anterior border of the lateral wall of the sac to the posterior lip of the conjunctival wound. A mucous membrane flap from the mouth provided the anterior wall of the anastomosis, having been sutured to the anterior edge of the medial wall of the sac and to the anterior lip of the conjunctival wound. A rubber drain was sutured and left in place for seven months, when it was replaced by a silver cannula. Ten months after the operation the cannula was removed. Two years later the patient reported no tearing or any other ocular discomfort. Peter C. Kronfeld.

Barri Rodríquez, Julio. **A contribution to dacryocystorhinostomy.** Arch. Soc. oftal. hispano-am. **7**:1141-1148, Nov., 1947.

The author discusses the advantages of the crown-shaped burr for making the nasal opening rapidly without danger of injurying the nasal mucosa.

J. Wesley McKinney.

Friedenwald, J. S., and Guyton, J. S. **A simple ptosis operation: utilization of the frontalis by means of a single rhomboid-shaped suture.** Am. J. Ophth. **31**:411-414, April, 1948. (2 figures.)

Gittler, R. **Successful treatment of blepharitis ulcerosa with albucid.** Proc. Ophth. Soc. Vienna p. 28, Oct. 26, 1942. 1942.

In a man, 43 years of age, severe ulcerous blepharitis responded neither to extraction of lashes, cauterization with silver nitrate nor X-ray treatment but healed within two weeks after intravenous injections of albucid. F. Nelson.

Godtfredsen, Erik. **Pathology of mucous and salivary gland tumours in the lacrimal gland and the relation to extra-orbital mucous and salivary gland tumours.** Brit. J. Ophth. **32**:171-179, March, 1948.

The modern, revised view of the genesis of mixed tumors is that they are not mixed at all but rather come entirely from the ectoderm; the apparent mesenchymal elements of these tumors are not mesodermal but ectodermal products of the epithelial cells which to a great extent undergo metaplasia. These changes may present all transitional forms from benign to malignant. There are two main histopathologic types: the fibro-myxo-epithelioma and the basalioma both of which may be benign or malignant. The

former occurs more frequently than the latter and malignant ones are more frequent than benign. Treatment consists mainly in surgical removal and irradiation. However, the best 5-year-cure reported is 50 percent.

The author presents 10 case reports. Exophthalmos, ptosis, visual impairment, palpable cervical nodes and palpable tumor were the most common signs and symptoms. Five of the tumors were malignant although from a biological aspect all are malignant because the tumor proliferation has a delerious effect on the optic nerve or the retinal vessels. (2 figures.)

Morris Kaplan.

Redi, Francesco. **Plasma cell granuloma of the lacrymal passages.** Rassegna ital. d'ottal. **16**:441-459, Nov.-Dec., 1947.

Three cases of plasma cell granuloma are described. Often these tumor masses are called plasmocytomas or plasmomas, which is incorrect, since these latter are pathologic neoplasms, which frequently metastasize to lymph glands and bones. As a result of this inexactness many plasmacellular granulomas are reported as plasmomas. Also occasionally included in the group are peritheliomas of the canaliculi. In the three cases described, the author suggests that the particular vascularization of the palpebral conjunctiva, the chemistry of the tears and the secretion of the various glands may play an important part in the etiology. It is also true that many cases described as trachoma of the lacrymal passages do not show the pathological changes characteristic of trachoma. (5 figures.)

Eugene M. Blake.

Sherman, A. E. **Choice of procedure in ophthalmic plastic surgery.** New York State J. Med. **48**:861-868, April, 1948.

General principles of ophthalmic plastic surgery are reviewed: (1) the early accurate repair of lacerations about the orbit with careful closure of subcutaneous tissue and skin often makes later repair unnecessary, (2) the use of intermarginal lid adhesions for two to three months after burns of the eyelids may be sufficient to prevent ectropion, (3) correction of deformities from lacerations or burn should not be attempted from three to four months after the initial repair because scar tissue will by that time become compact and relatively avascular, (4) scar tissue should be thoroughly excised and the tissues approximated without undue tension, (5) eyelid structures should be used to replace eyelid structures, (7) simple procedures should be followed, (8) a well-placed pressure dressing is very important.

Two cases of neoplasms are shown in which the simple excision of the tumors, with undermining and careful closure of the surrounding normal tissues was adequate. Two cases of deformities of the medial canthal area are shown. The first was repaired by excising scar tissue, mobilizing the lid and suturing a small tongue of denuded tarsus in a pocket up to the medial canthal ligament, and the other by means of excising all scar tissue and the tear sac, freely mobilizing the entire medial canthal area, removing displaced bone, transposing Z-plasty flaps, and overcorrecting the deformity. The correction of an eyebrow deformity is demonstrated by a Z-shaped incision and interposition of flaps. In this patient iliac bone grafts were used for orbital rim defects.

The Wheeler secondary implant is discussed. The implantation of an acrylic wedge (about 2½ cm. by 1½ cm. by 0.8-0.4 cm.) on the orbital floor to elevate the eye in cases of depression and enophthalmos due to fracture of the floor of the orbit, is described. Cicatricial contraction of a portion of the eye socket is corrected by excision of underlying scar tissue, adequate enlargement of that por-

tion of the socket, and the use of a mucous membrane graft from the inner surface of the lower lip.

When there has been extensive loss of tissue so that the best result one could hope for would be immobile unnatural eyelids with a staring conspicous artificial eye, he prefers to remove the remains of conjunctiva and lacrimal gland, and to cover the orbit with a continuous layer of smooth skin. (26 photographs.)

Alston Callahan.

Weekers, L. **The operative technique of ptosis: diathermic coagulation.** Ann. d'ocul. **180**:657-663, Nov., 1947.

In all cases of hypofunction of the levator, the Blaskovics operation is considered basic. As supplementary operations those of Motais and Machek may be advisable if additional superior rectus or orbicularis function is also needed. Skin excision may also be necessary. In the Blaskovics operation, the Agatston technique and diathermic coagulation of the tarsus are preferred. A 1-mm. electrode is used with a 4-mm. exposure and the current volume is adjusted at the time of operation. Diathermic coagulation is especially applicable in chronic inflammations of the palpebral connective tissues and the tarsus, such as trachoma. The term "blepharochalasis" is applied to several entities; one is characterized by epidermal relaxation followed by recurrent inflammation of the subcutaneous tissues and subsequent degenerative changes here and in the muscles. Depending upon the stage and severity, the operative procedures for the relief of blepharochalasis may include skin excision and the operations of Blaskovics or Machek.

Chas. A. Bahn.

Wheeler, Maynard. **Discoloration of the eyelids from prolonged use of ointments containing mercury.** Am. J. Ophth. **31**:441-444, April, 1948. (8 references.)

16

TUMORS

Loewenstein, A., and Foster, J. **Two unusual sclerocorneal neoplasms.** Brit. J. Ophth. **32**:1-12, Jan., 1948.

A small tumor appeared at the limbus in a 15-year-old boy and began to grow rather rapidly; it was yellow, painless and hard. Biopsy revealed a spindle cell sarcoma of a mature type, markedly vascularized and with giant cell formation in the vessel walls. A considerable number of large mast cells with big round nuclei was present. After the biopsy the remaining tumor grew faster than before and the eye was excised. The exact nature of the tumor could not be ascertained though it was felt to be a transmissible tumor, probably caused by a filterable virus. A second small tumor that arose from a degenerative pannus in a blind eye occurred in a 65-year-old woman.

The suggestion that a filterable virus was the etiologic agent is speculative and without proof, as the idea of animal inoculation was a fruit of the histologic investigation, when it could no longer be carried out. Such cases should in the future be investigated from the biologic viewpoint before the histologic. The amount of material required for injection into the anterior chamber of an animal is so small that it need not interfere with the usual histologic investigation.

Morris Kaplan.

Owens, N., and Stephenson, K. L. **Hemangioma: an evaluation of treatment by injection and surgery.** Plast. and Reconstruct. Surg. **3**:109-123, March, 1948.

Only surface hemangiomas are considered, and they are described as tumors of the independently growing blood channels with their origin in embryonic rudiments of mesodermal tissue. A brief but interesting history of their treatment is presented and various methods of therapy

are mentioned. The incidence in the female is twice that in the male. Fifty-two percent of all hemangiomas occur in the area of the head.

Important diagnostic points are the discoloration, reexpansion after compression, increase in size if the patient's head is lowered, and enlargement of the mass if the jugular veins are occluded by pressure.

Injection therapy is indicated in areas where surgical excision would require the loss of a part such as around the eye, nose or lip, or the exenteration of the orbit. A cure resulting from sodium morrhuate injection accomplishes the desired results and saves the functioning part of the body. Of 39 patients treated by this method the youngest was six weeks of age and the eldest 35 years. Five typical cases are reported, in three of which there were involvements of the eye and adnexa. From 0.5 cc. to 4.0 cc. of sodium morrhuate was injected from a tuberculin syringe with a 25 or 26 gauge needle, the amount being determined by the clinical appearance and the response at the time of infiltration. Smaller doses are used in areas about the eye or lip or in a mucous-membrane-covered surface. At intervals of from ten days to five weeks the injections are repeated. The injection of sodium morrhuate causes thrombosis with secondary sclerosis, atrophy, and absorption of the vessels. To be effective it does not have to come in contact with the vessel lining. Complications of injection were central necrosis and ulceration, and in one case diffuse thrombosis. No allergic reaction accurred and the necrosis was not painful. The authors have injected this sclerosing solution into the conjunctiva, but have not used more than 2 cc. at any one time in this area.

Surgical removal is utilized in areas where the problem of the loss of the part of the body does not exist and in patients in which the injection treatment has not been successful. The location of the tumor should be carefully considered, particularly with reference to the availability of tissue repair, the ease of surgical excision and the possibility of complete eradication by one surgical maneuver. Of the 56 hemangiomas removed by excision from individuals of from six weeks of age to 50 years, four are reported in detail, but in none of these were the eye or adnexa involved.

A case report of massive ocular and adnexal involvement is included in which neither excision nor injection was attempted because of the size of the lesion. The authors advised against carbon dioxide snow, Xray or direct application of radium or radon to surface lesions. This type of therapy has not proved successful in regions having well differentiated endothelium. Alston Callahan

17

INJURIES

Cibis, P. **Lid formation and lid elevation by means of fenestrated implants made from "Supramid."** Klin. Monatsbl. f. Augenh. 112:232-238, 1947.

The author used a plastic lid support for repairs of defects of the lower lid. This support rests on the lower orbital rim by means of a base plate. A fenestrated frame is attached to this plate and serves as a support of the structures of the lower lid to the contours of which it conforms. The material is inserted through a lateral incision after the scarred area has been loosened and extensively undermined. The author presents pictures of several cases of anophthalmus and trauma to the lower lid after military injuries. The method proved cosmetically satisfactory and no disadvantages or complications were encountered. (11 photographs, 3 drawings.)
Max Hirschfelder.

Cibis, P. **Plastic lid repair by pedicu-**

lated skin flaps in combination with creeping flaps. Klin. Monatsbl. f. Augenh. **112**: 238-243, 1947.

It is possible to transplant skin from distant parts by a repeated process of folding and subsequent stretching. This method was first used by Lexer in 1907 for repair of the eyebrow with skin from behind the ear. The author repaired traumatic defects of the upper and lower lid in the following way: he first implanted a pediculated flap from the forehead into the upper or lower lid. In a later operation he formed a double fold in line with the principles of the creeping flap. The fold was subsequently unfolded and stretched and served as material to repair the other remaining lid. The use of this type of flap from basal parts of pediculated flaps is recommended. (10 figures.)

Max Hirschfelder.

Leydhecker, F. K. **Experiments with a new assembly to prove the touching and grasping of metallic foreign bodies.** Klin., Monatsbl. f. Augenh. **112**:255-258, 1947.

The article describes a relatively simple electric assembly which is used in connection with a forceps made of two electrically isolated prongs of different metals. The sound produced in a loudspeaker varies from a short knock at touch to a lasting signal, when the foreign substance is firmly grasped. Max Hirschfelder.

Lindner, K. **Saving of infected eyes with injured lenses.** Proc. Ophth. Soc. Vienna p. 25. June 29, 1942.

Lindner advocates as thorough removal as possible of lenses which have been injured by perforating trauma and from eyes that have become infected.

F. Nelson.

Neubert, F. R. **An attempt to treat a perforated eye with subconjunctival penicillin.** Brit. J. Ophth. **32**:162-163, March, 1948.

This brief case report describes the unsuccessful use of penicillin in an eye with a severe perforation. A smear on the third day revealed the presence of penicillin-sensitive cocci. Subconjuntival injections of 50,000 units of penicillin in novutox and intra-muscular injections of 30,000 units were given. After three days the eye was much worse and was removed. The pathologic report indicated the presence of panophthalmitis. Morris Kaplan.

Papamatheakis, N. **Iridocyclitis caused by intraocular glass splinter.** Proc. Ophth. Soc. Vienna p. 38, Feb. 22, 1943.

Recurrent inflammation occurred some time after the eye had been injured in an accident. X-ray films revealed no intraocular foreign body, but 13 years later a very small glass splinter could be localized in the chamber angle at 6 o'clock and was removed under slit lamp control. Apparently even very small glass particles within the eyeball cannot be tolerated indefinitely. F. Nelson.

Paufique, L. **Anterior chamber puncture to facilitate scleral foreign body extraction.** Ann. d'ocul. **181**:35-37, Jan., 1948.

Preliminary paracentesis temporarily reduces the ocular tension, and is therefore a valuable adjunct to numerous operations. First among these is the removal of posterior intraocular foreign bodies. Vitreous loss and other complications may thus be avoided or minimized, especially if section of the extraocular muscles is necessary. In the removal of a posterior intraocular foreign body, the transcleral route is generally preferred. This is especialy true if the foreign body is imbedded in the coats of the globe or if its removal predisposes to uveal or choroidal prolapse or retinal detachment. An illustrative case is presented. Chas. A. Bahn.

Thiel, R. **Electrodynamic power effects on nonmagnetic metals. A method to re-**

move nonmagnetic foreign bodies from the eye. Klin. Monatsbl. f. Augenh. **112:** 258-267, 1947.

The theoretical background of this striking attempt to move non-magnetic metals by electric power lies in the utilization of so called "electrodynamic powers" and in the production of Foucault or eddy currents. Whereas it is difficult to abstract the theoretical parts of the article, the basis for the method may be described as follows. An alternating current of high frequency is sent through a primary coil. A Foucault current of opposite direction is created in a metal ring which lies in the electrodynamic field of this coil. A similar current corresponding in direction to that running through the metal ring is excited in a second nonmagnetic piece of metal which might well be an intraocular foreign body. As bodies containing alternating currents of equal direction attract each other, the second body, even though nonmagnetic, will move in the direction of the metal ring. Experiments in collaboration with the physicist Johann proved the correctness of this theoretical calculation. For practical use in ophthalmology one will need relatively high powers, and certain difficulties have yet to be solved. (6 references.) Max Hirschfelder.

Zwahlen, P. **Priscol in the treatment of ocular burns.** Ophthalmologica **114**:241-245, Oct.-Nov., 1947.

In severe ocular burns the University Eye Clinic of Lausanne uses the following procedure in order to decide whether conservative or surgical treatment should be instituted. The burned conjunctiva is pricked with a fine needle. If this prick causes no bleeding or pain whatsoever, the author believes surgical treatment, that is, replacement of the burned conjunctiva by a mucous membrane flap after Denig, is indicated. If the needle prick causes bleeding or pain, the eye is treated conservatively. The author has obtained gratifying results with repeated instillations of a histamine derivative called Priscol.

Peter C. Kronfield.

18

SYSTEMIC DISEASE AND PARASITES

Bardhan, P. N. **Reiter's disease.** Indian M. Gaz. **82**:577-580, Oct., 1947.

Four cases of Reiter's disease are reported. The triad of purulent urethritis, purulent and mucopurulent conjunctivitis, and arthritis usually affecting the larger joints characterizes the disease. Associated features are iritis, scleritis, keratitis, neutrophile leucocytosis, lymphadenitis and increased sedimentation rate. The etiology is unknown, the disease is not venereal and recovery is spontaneous.

Irwin E. Gaynon.

Fisher, E. D., and Main, L. B. **Tuberculous meningitis as a cause of papilledema.** Bull. Los Angeles Neurol. Soc. **13**:56-59, March, 1948.

Bilateral papilledema in a patient with symptoms of early tuberculous meningitis is reported. At autopsy a suspected space-occupying lesion was found to be a meningioma. It is emphasized that in tuberculous meningitis with papilledema, the presence of a coincidental tuberculoma or an associated intracranial tumor must be suspected. O. H. Ellis.

Lyle, D. J. **The ocular syndrome of cataract and papilledema in the manifest form of parathyroid deficiency.** Am. J. Ophth. **31**:580-584, May, 1948. (17 references.)

Rodriguez, R., and Root, H. F. **Capillary fragility and diabetic retinitis with a note on the use of rutin.** New England J. Med. **238**:391-397, March 18, 1948.

The literature on capillary fragility in relation to diabetic retinitis is reviewed.

Measurements of capillary fragility by the petechial index of Gothlin were done

in 156 diabetic patients. Forty percent of 100 unselected diabetic patients showed an increased capillary fragility. This abnormality was found in practically all patients with diabetic retinitis, whether or not hypertension was present. In 11 cases hypertension was present with increased capillary fragility, but no retinal damage was observed. In 56 selected cases of retinitis, no patients showed a normal petechial index; the petechial index was increased in 47, near the upper limit of normal in nine. The incidence of increased capillary fragility was related to the duration of the diabetes more clearly than to the age of the patient. Forty-one percent of 82 patients with retinitis were under 40 years of age, and increased capillary fragility was observed as early as the age of 21 years, but with long duration of diabetes.

Rutin was administered to 70 patients with retinitis and increased capillary fragility. The initial dose was 20 mg. three times a day, and this was increased to 40 to 60 mg. three times a day in 20 cases. (A dosage of 300 to 400 mg. daily may be used.)

Capillary fragility can be brought to normal with the use of rutin in sufficient dosage, but in no patient did the retinitis improve. Increased capillary fragility occurs in diabetic patients as an early evidence of generalized arterial disease and is closely correlated with the development of retinitis and nephritis.

Theodore M. Shapira.

Stuart, R. D., and McWalter, D. **Primary meningococcal conjunctivitis in children.** Lancet 1:246-248, Feb. 14, 1948.

Six sporadic cases of acute meningococcal conjunctivitis in infants and young children are described.

Meningococci were isolated from five of these infections and in four instances they belonged to group one.

In two instances meningococci were present in the nasopharynx of a close contact, and the probable source of infection was the respiratory tract.

Attention is drawn to a simple method for transporting specimens from an outlying clinic to a central laboratory, which overcomes the frequent difficulty of immediate culture. The possibility of confusion between meningococcal and gonococcal conjunctivitis is emphasized, and the importance of full bacteriological investigation is urged.

Theodore M. Shapira.

19

CONGENITAL DEFORMITIES, HEREDITY

Mata, Pedro, **Ocular manifestations of tuberous sclerosis.** Arch. Soc. oftal. hispano-am. 7:1176-1189, Dec., 1947.

An exhaustive description of the various manifestations of the disease, and brief reports of three cases are presented. A girl 16 years old, with a mental age of 9 years, had adenomas of Pringle, periunguinal tumors of Koenen, psychic disturbances, epileptic attacks, and typical retinal protuberances; cranial calcification was not demonstrable. Another patient, 17 years old, with Pringle's adenomas and mental retardation, died without developing retinal involvement. The third patient, 14 years old, had three typical retinal nodules, without other symptoms. (3 photographs, 2 fundus pictures.)

Ray K. Daily.

McCulloch, C., and McCulloch, R. J. R. **A hereditary and clinical study of choroideremia.** Tr. Am. Acad. Ophth. pp. 160-190, Jan.-Feb., 1948.

A genetic study was made of two families, with over 600 members, and 86 cases of this disease. In the female it is present in a latent form, causes no visual defects, and is essentially unchanged throughout life. In the males, however, the disease is progressive and begins at ages ranging

from 3 to 40 years. The first symptom is night blindness and in the very early stages, the fundus resembles the female type. The choroid is gradually absorbed with equatorial and peripheral field changes; central vision remains good. Mentality is not affected, but impairment of hearing is not infrequent. Choroideremia is a recessive sex linked character; the female is the carrier, the male has the progressive form of the disease. In the female, the differential diagnosis includes pigmentary retinal degeneration, diffused choroiditis and the salt and pepper type of chorioretinitis. In the male, the differential diagnosis includes pigmentary retinal degeneration, gyrate choroidal atrophy of Fuchs, diffuse choroidal sclerosis, choroidal atrophy in high myopia, and diffuse choroiditis (Oguchi's disease). The authors do not think choroideremia is a form of pigmentary retinal degeneration. Chas. A. Bahn.

McKernan, R. L. **Sturge-Weber Syndrome.** Tr. Ophth. Soc. U. Kingdom **65:** 407, 1945.

The author advises that the name be changed to "angiomatosis ophthalmicus" because of the similarity in the distribution of the focal manifestations to herpes zoster ophthalmicus.

Beulah Cushman.

Posner, A., and Schlossman, A. **The role of inheritance in glaucoma.** Tr. Am. Acad. Ophth. pp. 145-158, Jan.-Feb., 1948.

In this study of 373 unselected patients with primary glaucoma 51, or 13.7 percent, knew of one or more relatives who had the disease. These 51 belonged to 30 families. The mechanics of dominant, recessive and sex-linked heredity in glaucoma is explained as are terms like penetrance and expressivity. In 20 of 25 sibships the penetrance was 80 percent. In evaluating the specific roles of the several types of heredity in the constitutional predisposition to potential and actual glaucoma, at least two factors must be considered. First, there is no sharp contrast between dominant and recessive genes, which means that in sporadic cases the exact mode of transmission is not yet understood. Second, primary glaucoma is essentially a bilateral, progressive, constitutional, degenerative disease which affects both the corneoscleral filterability and the intraocular vascular permeability. A more careful study of the pedigree of glaucoma patients is advised. Charts of ten glaucomatous families are presented with their pedigrees carried to the third and fourth generations.

Chas. A. Bahn.

Rieger, H. **A family with irregularily dominant hereditary retinitis pigmentosa of atypical character.** Klin. Monatsbl. f. Augenh. **112:**203-213, 1947.

The author presents a family tree in which the mother, her offspring from two marriages and her grandchildren had atypical pigment degeneration of the retina. Not all the members were involved, but five had serious involvement of retina and choroid, resembling retinitis punctata albescens. Seven others had gross granular pigmentation of the fundus which is probably a more benign form of the same inherited process. The hereditary biological factors of this disease are discussed.

Max Hirschfelder.

Sauer, H. **Total atypical coloboma of iris and choroid and staphyloma verum in a child.** Proc. Ophth. Soc. Vienna p. 15, May 18, 1942.

A child was presented who had a normal right eye. In the left he had a large coloboma of the iris between 9 and 10 o'clock and another at 6 o'clock as well as a circumpapillary staphyloma verum.

F. Nelson.

20

HYGIENE, SOCIOLOGY, EDUCATION, AND HISTORY

Arjona, J. **Old age and the eye.** Arch. Soc. oftal. Hispano-am. **7**:1097-1110, Nov., 1947.

The ocular changes characteristic of old age in the eyelids, conjunctiva, cornea, iris, lens, vitreous, retina, and sclera are briefly described. Several suggestions for the alleviation of ocular symptoms in senile patients are made.

J. Wesley McKinney.

Campbell, D. A. **Clinical report on miners' nystagmus.** Brit. J. Ophth. **32**: 193-198, April, 1948.

The author presents a clinical survey of 44 certified cases of miners' nystagmus. The symptoms of active nystagmus, giddiness and photophobia were usually present. After medical supervision with rehabilitation and proper treatment, the average duration of disability was six months. These men are unable to return to work underground, but can fill good jobs if not required to work in poor illumination and in awkward postures. A plea is voiced for better working conditions underground, particularly in the matter of illumination. Orwyn H. Ellis.

Marshall, Don. **Military ophthalmology in the European theater.** Am. J. Ophth. **31**:545-561, May, 1948. (13 figures, 12 references. Discussion by F. P. Calhoun, Jr. and Trygve Gundersen.)

Maxwell, Euphan, **A cross-sectional view of injuries in an ophthalmic practice in Eire.** Brit. J. Ophth. **32**:134-153, March, 1948.

This very long article is a reminiscence of the author's many years of ophthalmic practice in Dublin. The review covers three-quarters of a century. Almost every conceivable complication of ocular injury was encountered and many of these are described. Morris Kaplan.

Nelson, H. A. **Eyes: compensation and medicolegal problems.** Tr. Am. Acad. Ophth. pp. 267-272, Jan.-Feb., 1948.

In medicolegal cases the doctor's function is to state his findings and conclusions without regard to the result. Efficient treatment of industrial diseases and injuries is obligatory. Necessary preoccupational and occupational examinations are strongly advised. The system used in Wisconsin is considered equitable to both employer and employee. A panel of physicians including ophthalmologists is selected by the State Medical Society, employers and insurance carriers. A choice of physician or eye specialist by the employee is made from this panel. Independent medical examiners are freely used by the state commission. Total loss of vision in one eye in Wisconsin entitles the victim to compensation of 250 weeks, enucleation, 275 weeks. The A.M.A. committee ratings are generally used. Permanent visual loss should not be estimated too quickly. Complicating conditions such as detached retinas, toxic cataracts and epidemic conjunctivitides must be evaluated individually on their merits. Intelligent coöperation among industrial physicians, employers and insurance carriers is strongly advised.

Chas. A. Bahn.

Sappington, C. O. **Medicolegal problems in industrial ophthalmology.** Tr. Am. Acad. Ophth. pp. 260-267, Jan.-Feb., 1948.

After a few general remarks a few case histories are reported, and a brief discussion of ophthalmic procedure in industry as an expert witness follows. Some twenty industrial chemical substances which may affect the eye internally are mentioned. Chas. A. Bahn.

Stern, E. S. **The psychiatric aspect of miners' nystagmus.** Brit. J. Ophth. **32**: 209-224, April, 1948.

The author presents detailed reports of psychiatric examinations of miners with and without nystagmus. Miners' nystagmus is a psychosomatic affection which usually does not develop until the man has been working underground in the dark and with an upward gaze for at least 10 years, and more commonly for 30 years. The dangerous occupation of mining, coupled with economic anxiety, produces a varying degree of conversion into a hysterical state and the presence or absence of nystagmus itself is relatively unimportant. These people should be under psychiatric supervision, and the term "miners' nystagmus" should no longer be used. Orwyn H. Ellis.

Vail, Derrick. **The teaching of ophthalmology.** Am. J. Ophth. **31**:535-541, May, 1948.

NEWS ITEMS

Edited by DONALD J. LYLE, M.D.
904 Carew Tower, Cincinnati 2

News items should reach the editor by the 12th of the month

DEATH

Dr. Louis Abraham Feldman, Brooklyn, New York, died February 2, 1948, aged 57 years.

ANNOUNCEMENT

CHICAGO CLINICAL CONFERENCE

The Chicago Ophthalmological Society announces its 2nd annual clinical conference to be given November 29 to December 4, 1948. Special attention will be paid to the pathologic and the clinical aspects of glaucoma and retinal diseases. Recent advances in general ophthalmic therapeutics will also be presented. The class will be limited to 50. For further information address: Miss Maud Fairbairn, 8 West Oak Street, Chicago 10, Illinois.

MISCELLANEOUS

IOWA POSTGRADUATE COURSE

The State University of Iowa, College of Medicine, gave a postgraduate course in ophthalmology on June 14, 15, 16, 17, 18, and 19. The course was under the direction of the staff of the department of ophthalmology: Dr. C. S. O'Brien, head of the department; Dr. J. H. Allen, Dr. P. J. Leinfelder, Dr. G. L. Walker, and Dr. Otis S. Lee, Jr.

The guest instructors and their subjects were: Dr. Moacyr E. Alvaro, "Hemostasis in Ophthalmology" and "Radiation Therapy in Ophthalmology"; Dr. A. D. Ruedemann, "Industrial Ophthalmology"; Dr. Paul A. Chandler, "Glaucoma"; Dr. Daniel B. Kirby, "Surgery of Strabismus," "Surgery of Glaucoma," "Surgery of Cataract," and "Complications in Eye Surgery"; Dr. Kenneth C. Swan, "Ocular Therapeutics."

SOCIETIES

AKRON GUEST SPEAKER

At the May 3rd meeting of the Akron Academy of Ophthalmology and Otolaryngology, Dr. E. Bruce Fralick, professor of ophthalmology at the University of Michigan, presented a very interesting paper on the "Surgical Anatomy of Glaucoma." Members of the Cleveland Club of Ophthalmology were guests of the Akron Academy.

CENTRAL ILLINOIS MEETING

The Central Illinois Society of Ophthalmology and Otolaryngology met on April 23rd, 24th, and 25th at the Orlando Hotel, Decatur. The guest speaker in ophthalmology was Dr. B. Y. Alvis, St. Louis, who discussed glaucoma and its various phases.

Two of the active members, Dr. Edgar T. Blair, Springfield, and Dr. G. E. Hartenbower, Bloomington, presented papers. Dr. Blair discussed "Gonococcal Conjunctivitis," and Dr. Hartenbower lectured on "Obscure Foci in the Throat."

The next meeting of the Society will be held at the Abraham Lincoln Hotel, Springfield, Illinois, November 12th, 13th, and 14th. The officers of the Central Illinois Society of Ophthalmology and Otolaryngology are: President, Dr. Clarence E. McClelland, Decatur; president-elect, Dr. Clifton S. Turner, Peoria; vice-president, Dr. Harold Watkins, Bloomington; secretary-treasurer, Dr. Philip R. McGrath, Peoria.

CHICAGO SOCIETY OFFICERS

The Chicago Ophthalmological Society has elected the following officers for 1948-49: president, Dr. Arlington C. Krause; vice-president, Dr. George P. Guibor; secretary-treasurer, Dr. J. Robert Fitzgerald; councilor, Dr. Cyril V. Crane; corresponding secretary, Dr. Richard C. Gamble.

READING MEETINGS

The 81st meeting of the Reading Eye, Ear, Nose, and Throat Society was held jointly with the Reading Dental Society. Harold M. Covert, D.D.S., chief of Oral Surgery Section, Allentown General Hospital, and Dr. Kerwin N. Marcks, chief, Department of Plastic and Reconstructive Surgery, Allentown General Hospital, presented a paper on "Diagnosis and Treatment of Mouth and Face Pathology."

On May 5th, the Study Club of the society was addressed by Dr. Ferris T. Ketcham on the subject "Pathologic Explanation of Common Ophthalmoscope Findings."

PERSONAL

APPOINTED SPECIAL LECTURER

Dr. Adalbert Fuchs has been appointed special lecturer in ophthalmology in the postgraduate division at New York University College of Medicine beginning October 1, 1948.